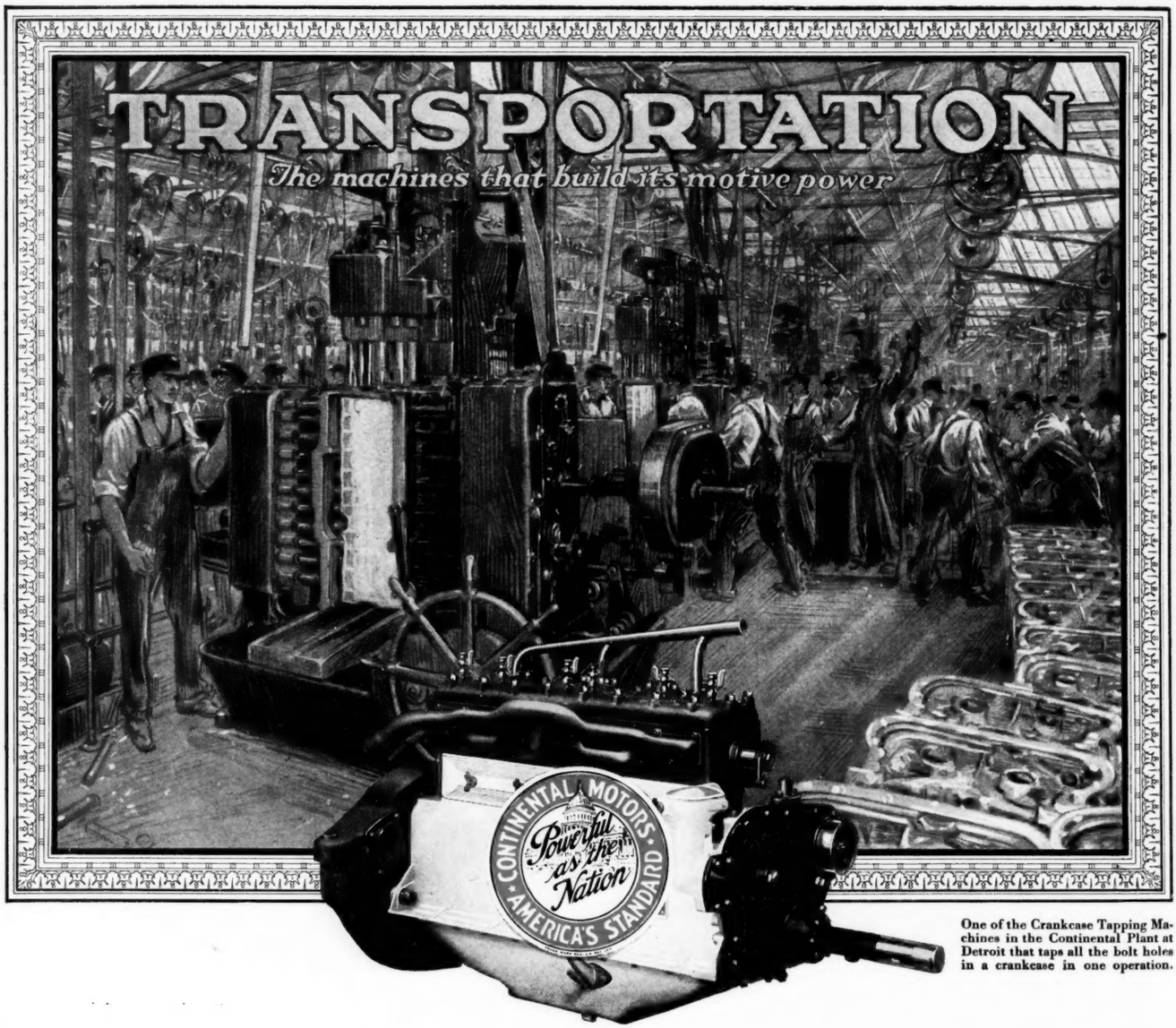
AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XLIV
Number 21

PUBLISHED WEEKLY AT 239 WEST 39TH STREET
NEW YORK, MAY 26, 1921

Thirty-five cents a copy
Three dollars a year

Entered as second-class matter Jan. 3, 1905, at the post office at New York, N. Y., under the Act of March 3, 1879



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VOL. XLIV. NEW YORK—THURSDAY, MAY 26, 1921 No. 21

S. A. E. SUMMER MEETING

Education Dominant Thought at S.A.E. Summer Meeting

President Beecroft points way to attainment of results. Discusses foreign trade. Intensive research by S. A. E. not to conflict with competitive research. Hot weather greets convention visitors on arrival.

WEST BADEN, IND., May 24.

THE Society of Automotive Engineers is holding the hottest meeting in its history. Although accurate temperature figures are not available, each of the six hundred persons registered are ready to testify that this is a real summer resort and that summer has arrived in full force. Most of the visitors, however, had some taste of the hot weather before leaving home and so no one is inclined to blame this section of Indiana for the exceedingly warm reception which has been accorded. Everybody is having a good time in spite of the high temperatures.

The attendance is surprisingly good; much better than was anticipated early in the season. Six hundred arrivals have already been registered, while reservations have reached 650. Many arrivals are yet unregistered, so that the total attendance will probably be about 700. The attendance last year was 757, which was the largest for a summer meeting in the history of the society.

Both sessions held to-day were well attended. A surprisingly large number sat through the rather extended meeting of the standards committee in spite of the heat. The hall was also well filled to-night when President Beecroft delivered his address. His remarks centered about the subject of educational work and were listened to with close attention. He discussed especially the relation of the engineer to foreign trade and defined the various kinds of research work in general, together with the function of the research work to be carried on by the Society. President Beecroft's address was as follows:

It is a welcome opportunity to have the privilege and the honor to address you as your president because of what our society has accomplished in its brief history of 16 years, and also because of the character of the times through which we are passing, and the problems lying ahead with which we must cope. We have passed milestones on the automotive highway, but the future is not so clearly defined as we had hoped a few years ago it would have been, and within 12 months we have been brought face to face almost brutally with situations that have been anticipated by few, if any, in our industry. Our greatest concern is with the immediate future.

Within the last 12 months we have seen waves of industrial depression follow one another in long successive undulations, beginning at the Atlantic and ending at the Pacific. We have not only watched these waves traverse the breadth of our land but have seen them pursue their undulatory course across the Amer-

icas to our south, across Australia, Africa, Asia and devastated Europe, until we could not locate a single center on the earth's surface that seemed immune from the depression that we are still in the midst of.

We are not yet through liquidation, and are barely on the threshold of the adjustment period that lies ahead. These are days when courage is needed; when the fibre of which men are made is under the supreme test and when integrity and self-reliance are essential attributes of success.

This situation has suggested the subject of these remarks, namely, education, a more general consideration of fundamentals, a greater probing of one's self, and the development of greater self-reliance. In no field of human endeavor are these qualities more essential than in engineering, and this is specially true in a department of engineering such as transportation, with which we are connected and which is so inter-woven with all of the other industries of the world.

In transportation we must play our rôle and it must be a just and equitable one. We must give to the railroads what they can best do; we must give to the motor truck that which it can transport more economically than other means; to the commercial airplane should go that which can be best transported by it. There must be no inefficient wasting of the work by any form of transportation attempting to take onto itself that which can be more economically done by another medium of transportation. Corporational selfishness may exhibit itself and for a short time win, but in the end the economical will triumph, and in transportation, the straight line, as representing the greatest efficiency, will win. Heretofore the different kinds of transportation were warring more or less among themselves, vainly trying for the victor's share of the spoils. But a change of attitude has been exhibiting itself recently and now railroads are admitting the right of the motor truck in certain divisions of the transportation world, and are ready to leave those fields to it. Let the law be, render unto Cæsar that which is Cæsar's and to God that which is God's.

If the engineer is to maintain the status of his profession and pursue the ideal of seeking after the truth, then the pursuit of education must be an ever present and primary consideration. He must breathe the spirit expressed in the words of Ulysses: "To follow knowledge like a sinking star beyond the utmost bound of human thought . . . to sail beyond the sunset, and the baths of western stars until I die . . . to strive, to seek, to find, and not to yield."

For the first time in our industry since we shed our swaddling garments we are measuring ourselves with the other automotive manufacturing nations of the world. Before the war we were not an exporting nation, as our factory expansion which gave us the production we have to-day was developed during the early years of the war.

Previous to 1914 our foreign trade was a diversion; to-day it is a necessity. We find ourselves with factories of greatly expanded capacity, greater capacity than our domestic demands can absorb, and we are faced with the alternative of remaining in and increasing our position in the markets of the world or reducing output and depriving ourselves of the lower production costs we attained by virtue of volume production. For six years we have been in the markets of the world in a more or less representative way, but, lest we forget, may it be recalled that the world markets sought our wares and the world's buyers knocked on our doors; our task was easy—we opened the doors, took the remittances and delivered the merchandise.

Easy come, easy go, is an old proverb, yet still applicable and we might also further fortify ourselves by borrowing from divine writ words that can be applied to our foreign trade situation—namely, "Wherefore let him who thinketh he standeth take heed lest he fall."

Perhaps to some engineers foreign trade may seem far afield, but only last week the president of one of our greatest railroad systems in his testimony before the Interstate Commerce Commission attributed the present decline in railroad traffic to the falling off of our foreign trade, falling off $657,000,000 in three months of 1920 as compared with 1919. Not only has foreign trade affected our railroad systems but it is affecting all industries, and whatever factors affect the industries with which he is connected should properly be a matter of concern to the engineer.

Foreign trade, while directly a merchandising activity, has a very direct connection with engineering and its future will be to no small extent dependent on the knowledge the engineer has of the conditions and the characters of the people in the countries in which his product must perform. Some four years ago, when our expert sales departments ruled that a magneto was not necessary equipment because of our developed battery ignition systems, it was soon learned that conditions in many lands demanded the magneto, and, despite rulings, those companies that disregarded rulings and fitted the magneto were well repaid for their consideration. Others, who for a time resisted, were soon converted to the necessity of the magneto. In the end it was an engineering question, and, while from a merchandising viewpoint the dropping of the magneto seemed desirable in that it facilitated the production, yet in long-distance view, which should be the engineering view, it proved necessary. It is because of many situations of this character that engineering must be more intimately associated with such factory activities as merchandising and maintenance as well as with design and production.

The factory engineer becomes immediately a direct party to foreign trade. When sales in certain lands are decelerated, due to gasoline selling at $1 per gallon, or in another country where the horsepower tax is $5 per year per horsepower, we get a close-up realization of how interwoven engineering is with merchandising and how only the engineer thoroughly familiar with the fields in which his product goes can serve his company best. The engineer has not sufficiently weighed the factors involved in domestic trade, not to mention foreign trade.

It was not necessary until a year ago, as we had no world competition, but to-day, with European nations entering the field and with some of them actively in it for a year, it is necessary, if we are to retain our position, to give early consideration to these and other related questions.

To draw a parallel from our domestic field, two of our large farm tractor manufacturers have within the last thirty days concluded that the high cost of fuel in comparison with animal power has been one of the deterrents to the sale of farm tractors this year. If this becomes a considerable factor at home, where fuel is cheap and the machine is marketed at low cost, as compared with prices at which it must be sold in foreign fields, how much more a consideration does it become with $1 per gallon fuel and machine prices nearly doubled, due to freight, insurance, customs and shipping charges?

Only one year ago we found serious engineering de-

fects in certain cars in our own country, due to physical characteristics on our own Pacific Coast, and yet the engineer was ignorant of the facts and, still worse, obstinate in his conviction that he was right. It was finally the sales end that converted the engineer, whereas it is the duty of the engineer to be a guide to the sales and correct them where necessary. The engineering mind must give consideration to those factors that directly affect his company.

As engineers, be constantly remindful of the fact that your task is far from completion, and, while in the last thirty years, scarcely a generation, we have seen a measure of progress scarcely comprehended to-day, yet the goal lies far beyond the distant hills. Education is the greatest need of the hour in present-day engineering, and in this we may gain hope and inspiration in pursuing education along its devious paths from Lessing, the German philosopher, who in his "Education of the Human Race," speaking on the broad subject of evolution and the devious paths it pursues, which in places can scarcely be followed, says:

"Go thine inscrutable way, Eternal Providence, only let me not despair in Thee because of this inscrutableness. Let me not despair in Thee even if Thy steps appear to be going back. Is it not true that the shortest line is always straight?"

Education should only begin when college doors close behind us. The man does not truly live whoever concludes that his education is completed. "Education gives to man nothing he might educe for himself. It gives him that which he might educe for himself only easier and quicker. This in the same way that revelation gives nothing to the human species which the human reason left to itself might not attain, only it has given and still gives the importance of these things earlier."

The extension of knowledge and securing it quicker and easier is one of the functions of our society that your council has given consideration to since the first of the year and which was under consideration last year. Under the term research as related to our society, the dominant thought is securing of certain knowledge earlier and with less expenditure of effort and with greater conservation of the talent available for such work.

Your council has seen fit, after deliberate and mature consideration, to actively push the creation of a research committee that will take its place in the society activities along with standardization work. It is impossible to see what development lies ahead and what expenditures this department may make for the next few years, but in magnitude the research organization should exceed that of standardization and the growth of the department is only dependent on the enthusiastic support that is given by the membership.

Let us briefly analyze what research is, as contemplated, and what it would mean to our society and the members:

First, there has been no thought of creating a special research laboratory for the S. A. E. in which to carry on experiments necessary in any research, but rather that existing laboratories in the industry and outside of it be utilized for such work. The finances of the society would not permit of creating a special laboratory, and the feasibility of such would be gravely questioned at this time. There are in Government bureaus, such as the Bureau of Standards and the Bureau of Mines, and in our college laboratories and in our industrial laboratories ample equipment for all necessary research, and it would be wasteful to neglect the intelligent use of these facilities.

Second, there has been no thought in the research program as considered to encroach on what might be described as the secret developments of any corporation. There is nothing communistic or that flavors of engineering socialism in the contemplated program. The research program contemplates nothing more than has been considered as beneficial co-operation in associations of manufacturers. We have for years, even for centuries, considered these industrial associations, formerly known as guides for the efficient promotion of trade, not only desirable but essential. We are to-day accomplishing through them results not considered within the vale of possibility a few years ago.

There is nothing in the research planned that usurps the programs of the engineer to-day. There is no thought of extracting the scientific discoveries of one company and distributing them broadcast to the remainder of the industry. Rather research, as planned, is to do the things that thus far have been left undone. It is to obtain certain knowledge not only easier but quicker and to be more certain of its accuracy.

The term research will admit of certain analysis and, for our present convenience, we may consider it under three heads or classes:

1. First there is what might be designated explorational research, conducted in different fields, which is a purely scientific research largely conducted by individual scientists with the thought of extending the boundaries of human knowledge. This research is akin to an explorer starting on a mission of discovery in an unknown field, a case in point being that of the Scandinavian astronomist who has led a life of study in his observation stations within the Arctic Circle, where for twenty years he has studied the Aurora Borealis and as a result has established certain scientific relationships previously unknown to science and by virtue of which new scientific areas, so to speak, have been brought into the field for intensive study by the scientific and engineering world. With us this research program has little to do. It has not been considered as one of our major activities. It must be left to the physicist, the chemist, the mathematician and the general scientist.

2. Secondly, and related to explorational research, is what might be designated intensive research in the fields brought within the ken of engineering by explorational work. This intensive research field is the one that our program has to do with and in which our interest is greatest. It is in this field of intensive research where economy in effort is most needed and where the measure of work for an end accomplished is greatest. This intensive research is a job that involves co-operation and organization, and the talent used can rarely be used in explorational research.

An example of the research activity in this field might be work relating to fatigue in metals. Such work would involve an almost endless number of experiments and tests extending over long periods of time and over a wide range of materials and under varying conditions. Some of our universities have been conducting searches of this character in which tests have been carried on for over a year and are still far from completion.

These experiments in themselves do not give the answer to fatigue, but the findings must be interpreted, and from these interpretations deductions made so that it may be possible to predict the fatigue resistance of

metals. Intensive researches of this and similar character have and are in progress, and are supported by large industrial corporations who have their own research laboratories and who recognize the magnitude of the work and the urgent necessity of it by their liberal support.

3. The third kind of research is industrial or development research, which for convenience may be designated competitive research among manufacturers in the same field of industry, and is a research which our program takes no part in. Competitive or development research has largely to do with developing a design of a part or completed unit or entire vehicle for manufacture or patent protection. This is the research that many corporations are more directly concerned with and which their laboratories are largely engaged upon. This is the research generally carried on behind locked doors carrying the sign "positively no admission." This is the research which provides the manufacturing secrets of a corporation. Our contemplated program leaves such research where it is to-day, solely with the manufacturer where it rightly belongs. Our program does not even hint at unlocking the door or removing the sign. Competitive or development research is a company activity and must remain such.

Careful discrimination between this competitive or development research and intensive and explorational research must be constantly kept in mind. Research of the intensive character will tend to increase possibilities for competitive and development research rather than restrict them.

Considering the influence of turbulence in connection with the internal combustion engine, the knowledge of turbulence elevates the standard of practice of the entire industry to a higher and wider level on which each corporation interested has greater possibilities for individual development, patent protection, etc. It is only by a recognition of this that we will progress in knowledge as the demands of the day require.

May we interpolate, "research gives to man nothing he might not educe for himself, but it gives it to him easier and quicker." So with intensive research; the cost is so great and the time needed so long that only by co-operation and organization in the long chain of tests can we secure the knowledge quicker, easier, cheaper, and are sooner able to incorporate the results in industry. Do not forget, art is long and time is fleeting.

One great need to-day is the training of men competent to carry out the intensive research, needs not alone of our colleges but of our industries. Our colleges are not graduating enough men of research caliber to care for the needs unless co-operation and organization are used. We must conserve the human material we have available. No persons are more conscious of this shortage of research personnel than our college heads, and no one regrets this more than they do. Too frequently the curriculum are not conducive to such training.

Up to the last few years there has been little thought of co-operation for conservation in college research, and still less thought of co-operation in intensive research in industrial plants. There is to-day not only a lack of appreciation of research by the engineers but by company executives, and, just as our standardization program met with opposition at its inception and still does in some quarters, so we may anticipate opposition in research until it is more adequately understood.

Research is not going to deprive any engineer of his present work, rather it is going to enable him to obtain results which otherwise might not be possible. It is going to provide him with an arsenal well stocked with knowledge that will serve him and speed his efforts to better work.

Our research committee has had one specific object in mind; namely, securing as the director of this work a man competent not only to carry on intensive research work but to be capable of the more difficult task; namely, to correctly interpret the results obtained from such. There is a lack of uniformity of interpretation of results obtained and a consequent failure to reach conclusions and make correct deductions. In some intensive researches conducted by one engineer certain factors are neglected in experiments, so that comparison of results of experimentation covering the same field by other groups of engineers cannot be made. The measure of result that should have been achieved for the effort expended is not achieved. The money has been expended. The useful time has been consumed; the human energy has been consumed, but results are not what they should have been. A competent director should, with reasonable co-operation, be able to eliminate such losses.

Had we a surplus of human research talent our program for intensive research would scarcely be necessary, but with a shortage of available men the need for such co-operative work becomes imperative. In considering our research problem we suggest that the word research be divested of early associations and your conception of it be revised and that it be weighed in the light of the work to be done, the end to be accomplished and the tools and personnel available, keeping in mind the differences between intensive and competitive research. Do not forget that the confines of competitive and development research are not to be invaded or molested by our work, but that the field for such is to be broadened and lengthened by the intensive research program contemplated.

No time could be more appropriate than the present for the commencement of such work. In times of prosperity, when a company wishes a result along a certain research line, the answer is wanted almost immediately. Such is not possible. By beginning now the program will develop with a readjustment of the industry, and some progress will be made by the time urgent demands are coming in.

There is no thought in a co-operative intensive research program such as outlined of discouraging similar researches by corporations equipped and manned for such or of interfering in such work; but as with similar researches in the electrical and other fields, those corporations privately equipped for such work have been liberal in contributing their aid and finances for co-operative research. Such work will have a very desirable influence by creating greater self-reliance on the part of the individual engineer which will be engendered by such work. Those institutions that have made greatest progress in such work tell us that the personnel has very largely to be trained to the work.

Colleges by virtue of their curricula do not make research engineers. Individual training is necessary. Self-reliance is essential. Ability to proceed step by step from the known to the unknown is essential. The French philosopher, Rene Descartes, in the sixteenth century gave us a good example of what can be accomplished where self-reliance is developed. In his "Discourse on Method," in which Descartes laid the foundation work for modern thought and made possible the whole modern philosophic development, he says:

"Men should gather the greatest satisfaction from progress made in the search after truth. In the same

way I thought that the sciences contained in books composed as they are of the opinions of many different individuals massed together are further removed from truth than the simple inferences which a man of good sense, using his natural and unprejudiced judgment, draws respecting the matters of his experience. . . . The long chain of simple and easy reasonings by which geometers are accustomed to reach the conclusions of their most difficult demonstrations has led me to imagine that all things to the knowledge of which man is competent are mutually connected in the same way, and that there is nothing so far removed from us as to be beyond our reach, or so hidden that we cannot discover it, provided only we abstain from accepting the false for the true and always preserve in our own thoughts the order necessary for the deduction of one truth from another."

To-day, as always, the greatest problem in engineering is the engineer. Man dominates here as in all other spheres and only in proportion as the man, tagged as he may be with the title of engineer, etc., plays his part and considers the attainment of knowledge as the chief end in life, will our industry develop and will we reach that stature and be capable of measuring ourselves successfully with the nations of the world as we should.

We have been parties of an industry whose lot has been an easy one. As an industry we have grown by leaps and bounds. Our progress has been comparable to that of an army in the field that has made great gains of territory without adequately consolidating its position as it progressed and suddenly finds itself in an unexpected situation. We have not at all times taken accurate measure of our progress nor taken a sufficiently long-distance survey of the future. We are now at a time when looking ahead is more necessary than it has been heretofore. We require better qualifications to cope with the situation. For the first time we are in a world's competitive market; a market in which merit counts, and no effort must be neglected, no stone left unturned to fit us in the highest stage of perfection to meet the tasks that lie ahead.

The report of the treasurer showed the society to be in excellent financial condition, the net assets being over $130,000. This is about the same as last year, despite the heavy depression period through which we have passed.

C. F. Scott, chairman of the Meetings Committee, reviewed the last few meetings in his report and stated that seven general technical sessions have been held. Among the future meetings which have been arranged are several special sessions, including a joint gathering of the S.A.E. and A.S.M.E. at the Aberdeen, Md., Proving Grounds. This meeting will be held some time in October and has been arranged at the invitation of the Ordnance Department.

The annual motor boat meeting will take place as usual in New York City during the motor boat show. The date of the annual winter meeting has not yet been fixed. It will not be determined until the date of the New York show has been announced. It has been suggested that the winter dinner and carnival be combined into one affair this year. The Meetings Committee is considering the holding of extension meetings in industrial centers where no sections are now located.

The Sections Committee reports that there are now eleven sections in the society. The new additions since last year are Boston, with a membership of 57; Dayton, with 60, and Washington, with 25. The members in California have had two luncheon meetings, but a section in that State is not being planned at this time. The number of section members for 1921 is 1209 as compared with 1085 a year ago. The Society now has 5468 members. A year ago there were 5231. The membership committee reports a steady growth in all grades of membership. The full members now total 2790, an increase of 84 for the year.

Three members of the Nominating Committee were elected at the meeting to-night. Because this committee is to complete its work during the meeting held here, it was required that all the nominees be present. Those elected were: George P. Dorris of St. Louis, Elmer A. Sperry of New York, and R. E. Northway of Boston.

The other members of the Nominating Committee are elected and reported by the various sections. They are: Boston, L. W. Rosenthal; Buffalo, H. R. Corse; Cleveland, A. E. Jackman; Dayton, T. A. Midgley; Detroit, Russell Huff; Indiana, W. G. Wall; Metropolitan, H. W. Slauson; Midwest, Force Bain; Minneapolis, A. W. Scarritt; Pennsylvania, F. W. Germane; Washington, H. C. Dickinson.

The Standards Committee held one of its most successful meetings. It passed practically all of the standards as printed in AUTOMOTIVE INDUSTRIES of last week. The exceptions were that portion of the parts and fittings division which affects studs and the report on battery ratings for isolated plants. Both were referred back to their respective committees for further consideration.

Hard Copper

EACH month numerous requests are received by the Bureau of Standards for information concerning the hardening or tempering of copper. As the information desired by all those writing to the Bureau appears to be about the same, it has seemed desirable to make a short statement on this subject.

There is nothing new or mysterious about hardened copper. It is not one of the lost arts; immense quantities are in commercial use and added uses for it are being found every day. There are two well-known methods of hardening copper, the first being by means of mechanical working, while the second is to alloy it with a certain amount of another metal and in some cases with more than one metal. As examples of the first kind of hardened copper, we may consider hard drawn copper wire and cold drawn tubing. The wire used for every-day trolley systems is a good example of one of these classes. Copper hardened by the second method is not usually referred to as copper but as brass and bronze. Many persons apparently ignorant of the fact that hardened copper is in use every day have so manipulated the melting of copper in their experiments that the resulting melt is impregnated with oxide. Cuprous oxide is soluble in molten copper and alloys with it in exactly the same sense as the metals mentioned above. Copper treated in this way is considerably harder than the pure metal but is unsuited for most commercial purposes.

The above information will come as a disappointment to the many thousand metallurgical sharps who have rediscovered the secret of the ancient Egyptians within the recollection of the present generation alone.

S. A. E. SUMMER MEETING

Cylinder Actions in Gas and Gasoline Engines

Condensed from a paper prepared for the Semi-annual S.A.E. Meeting by Sir Dugal Clerk, the eminent British authority on gas engines. Inflammation, turbulence, specific heat of gases and other items are discussed.

SIR DUGALD CLERK, in his paper prepared for the S.A.E. Summer Meeting, discusses various phases of the combustion in engine cylinders in the light of experimental results obtained by himself and others. Most of his experiments were made with coal gas, and while the numerical results are not exactly the same as would be obtained with gasoline, they throw much light on what may be expected in gasoline engines. The principal actions common to all internal combustion engines are described as follows:

During the suction stroke of the ordinary four-stroke internal-combustion engine, the charge of air and gas or air and gasoline vapor and spray flows through the valve opening at a velocity which usually exceeds 100 ft. per sec. or 68 m.p.h. It enters the cylinder and fills it with a mixture of the fresh charge and the exhaust gas remaining from the last power stroke, all in a state of violent agitation or eddying. This agitation dies down in time, but at the end of the compression stroke, just before ignition, there remains a considerable internal motion. In a gas engine of 9-in. cylinder diameter and 17-in. stroke tested by me I found the residual turbulence at that point sufficient to increase the velocity of the spread of the flame after ignition to three times that which occurs in a still mixture of the same composition. As this state depends on the piston speed, an increase of the piston speed causes an increase of the initial turbulence, and hence a more rapid spread of flame to meet the increased rate of piston movement. Without this automatic change of ignition rate the high-piston-speed gasoline engine would have been impossible.

During the suction stroke the mixed charge passes through the valve opening at the temperature of the atmosphere, in the case of the gas engine, but somewhat below it in the usual case of the gasoline engine, due to evaporation of the liquid fuel; and as the valves and piston-end and cylinder walls are hotter than the charge, heat flows into it, and whenever the charge is complete its temperature is raised in a gas engine to about 212 deg. Fahr., partly because of the heat-flow into the charge and partly because the cool charge is mixed with a certain proportion of hot exhaust-gases at beginning of suction stroke, whose temperature is about 930 deg. Fahr.

This mixture at the suction temperature of 212 deg. Fahr., when compressed in the engine mentioned which has a 5.5 compression-ratio, rises to about 680 deg. Fahr. at a pressure of about 120 lb. per sq. in. above atmosphere. On ignition the temperature rises to a maximum of 2912 deg. Fahr. in about 1/40 sec., and the maximum corresponding pressure becomes about 330 lb. per sq. in. above atmosphere at nearly 1/20 of the forward stroke. The speed of this engine is 200 r.p.m., so that one revolution takes 0.30 sec. and a single stroke 0.15 sec. Had turbulence been absent at the time of ignition it would have required nearly 0.1 sec. to complete the spread of the flame and the maximum temperature would not have been attained till half stroke forward.

The time of inflammation necessary for a gasoline engine running at 1200 r.p.m. is much shorter; at this speed it should not exceed 1/120 sec., and at higher speeds much greater rapidity is required to give reasonable efficiency. The late Dr. W. Watson gave 1/300 sec. as the time in a small gasoline engine tested by him. Assuming the flame to travel 4 in. to fill the small cylinder, then its velocity must be 100 ft. per sec.

With gasoline engines operating at 1600 r.p.m., with overhead valves opening directly into the cylinder which was 7.25 in. in diameter with an 8.50-in. stroke, Sir Dugald obtained an indicated thermal efficiency of 33 per cent, and this value is about 0.7 of the air standard and about 88 per cent of the actual working-fluid standard. Mr. Ricardo has designed and built a special single-cylinder gasoline engine arranged so as to permit of altering the compression-ratio while the engine is running. He has published (Table 1) the maximum indicated thermal efficiency obtained at values of 1/4, 1/5 and 1/7 respectively for $1/r$. To enable this wide compression range to be attained he used benzol. Mr. Ricardo followed Sir Dugald in giving an approximate formula for the actual working-fluid efficiency at different compression. The latter proposed the use of a value of 1.285 for γ for the particular fluid of the gas engine; for the products of combustion of benzol and gasoline Mr. Ricardo uses 1.295.

TABLE 1—VARYING COMPRESSION-RATIO EXPERIMENTS USING BENZOL

Compression-Ratio	Maximum Indicated Thermal Efficiency Calculated $E=1-(1/r)^{0.296}$	Maximum Indicated Thermal Efficiency Observed	Ratio of Observed to Calculated Thermal Efficiency	Air-Cycle Efficiency	Ratio of Observed Thermal Efficiency to Air-Cycle Efficiency
1/4	0.337	0.277	0.82	0.425	0.650
1/5	0.380	0.316	0.83	0.475	0.665
1/7	0.440	0.372	0.85	0.540	0.685

The change from ¼ to 1/7 compression-ratio raises the indicated thermal efficiency from 27.7 to 37.2 per cent; that is, only 74.5 per cent of the fuel used at the low compression is required to produce the same power at the higher, and the ratio between no heat loss and practice rises from 82 to 85 per cent. The mechanical efficiency also rises, so that the saving is well worth making. The air-cycle ratio varies from 0.650 to 0.685, practically 0.7, the same as with the gas engine.

Sir Dugald referred to the subject of detonation and said that it was a very old trouble, as he experienced it with the first (two-stroke) engines he built in a very pronounced form. In later engines he overcame the trouble

by using what he refers to as exhaust super-compression, that is, injecting cooled exhaust gases into the cylinder at the charging end of the stroke so as to raise the pressure of the charge to 3-5 lb. p. sq. in. above atmosphere before compression began. He expressed the opinion that trouble from knock in present day kerosene engines could be eliminated by using a mixture of exhaust gas from the engine with the air entering the cylinder.

Turbulence

Reference is also made to the subject of turbulence, and in this connection Sir Dugald claims to have discovered that the turbulence created by the high velocity of the air and gas in entering the cylinder, persists during the compression stroke of the gas or gasoline engine to a sufficient extent to affect profoundly the rate of inflammation of the compressed mixture. This investigation was made in 1911. Long before that time he was fully aware that (*a*) turbulence existed in the engine cylinder during the admission of the charge through the inlet valve and passage and (*b*) that if turbulence be produced in a mixture of gas and air the inflammation of the charge proceeds more rapidly.

The flame velocity in an engine varies with the suction velocity and also with the gaseous or liquid fuel employed. Thus in one large cylinder gas engine of 22-in. diameter and 34-in. stroke, running at 160 r.p.m., the explosion period with Mond gas, suction gas and coal gas was respectively 1/21, 1/24, and 1/38 sec., and the corresponding flame velocity 47, 54 and 85 ft. per sec. The inlet velocity was 160 ft. per sec. In a smaller gas engine the inlet velocity was 100 ft. per sec. and the flame velocity 37 ft. per sec. With the richest mixtures used in gas and gasoline engines the flame temperature rises as a maximum value to 3632 deg. Fahr., although one set of experiments made by Professors Dalby and Callendar reached 4352 deg. Fahr. In both gas and gasoline engines the rate of flame transmission with turbulence varies from 30 to 100 ft. per sec.

Sir Dugald says that in a book on The Gas Engine published in 1886 he developed the thermodynamics of the engine and deduced the equation for thermal efficiency in terms of compression ratio as follows:

$$\varepsilon = 1 - (1/r)^{\gamma-1}$$

where $1/r$ is the compression ratio. This is now often referred to as the air standard efficiency. It has the following values for different compression ratios: ½ — 0.246; ⅓ — 0.360; ¼ — 0.430; 1/5 — 0.480; 1/6 — 0.510; 1/7 — 0.550; 1/10 — 0.610; 1/20 — 0.700; 1/100 — 0.850. A Committee of the Institution on Efficiency of Internal Combustion Engines adopted this standard. It made tests on three engines, of 5.5, 9 and 14 in. bore respectively, all using a compression ratio of 5.5, and by dividing the indicated thermal efficiency by the air standard efficiency the result was 0.61 for the 5.5 in. bore engine, 0.65 for the 9-in. bore and 0.69 for the 14-in. bore engine. As a result of many tests it can be accepted that in practice, if we calculate the maximum indicated thermal efficiency from the corresponding ratio of the air standard, 0.6 can be taken as the minimum and 0.7 as the maximum.

It was known in 1905 that the specific heats of the products of combustion are higher than that of air and that they increase with rise in temperature, but the specific heat values were very uncertain. Accordingly Sir Dugald set to work with the largest engine available to the Committee on Efficiency of Internal Combustion Engines and determined the specific heat of the flame in the combustion chamber by a new method depending on alternate compression and expansion of the flame within the cylinder. As a result he reached the conclusion that the engine converted into indicated work 88 per cent of the heat which it possibly could have converted into work, considering the properties of the working fluid. These tests were made on a slow speed large bore engine, but recent experiments made by Mr. Ricardo have shown that equally good results can be obtained with gasoline engines.

In 1911 Sir Dugald observed that the rate of explosion rise in an engine varied with the rate of revolution, and he ascribed this to the turbulence or eddying caused by the rush of gas into the cylinder during the suction stroke, which persisted during the compression stroke. In most gas and gasoline engines the mean velocity of charge-flow through the inlet-valve is at the rate of 100 ft. per sec., and flame carried at this rate would completely fill the combustion space of this engine in about 1/130 sec., as the distance from each igniter to the extreme wall-limit is about 9 in. The actual time taken for normal complete inflammation was respectively 1/27 and 1/30 sec., so that the rate of normal flame-propagation with turbulence was about $100 \div 4.5 = 22.25$ ft. per sec., while the rate with trapped ignition and turbulence nearly-died-down was about 8.9 ft. per sec. From this it appears that the effect of suction turbulence is to increase the rate of inflammation about 13 ft. per sec. in this particular engine running at 180 r.p.m. The rate of inflammation in Clerk's closed-vessel experiments with a similar mixture was about 4 ft. per sec., and in Bairstow and Alexander's corresponding experiments 2.5 ft. p.s. In a large vessel having a capacity of 6.2 cu. ft. with a similar mixture, Hopkinson found the rate of inflammation 5 ft. p. s. The velocity of inflammation in an actual engine is thus from 4 to 5 times that found in a closed vessel by Clerk and Hopkinson, and 9 times that found by Bairstow and Alexander. Clerk's experiments would suggest a residual turbulence effect in this engine at the moment of about 20 ft. p. s.

The late Professor Hopkinson experimented on turbulence at the same time, but he operated in a closed vessel and produced his turbulence by the rotation of a fan within the mixture. He used a cylindrical vessel 12 in. in diameter by 12 in. long, with the fan mounted at the center. The experiments showed a great increase of the speed of inflammation consequent on the motion of the gas. With a mixture of 1 part of gas and 9 parts of air by volume, the time from ignition to maximum pressure with the gas at rest was about 0.13 sec.; with the fan running at 2000 r.p.m. it was reduced to 0.03 sec., and at 4500 r.p.m. to 0.02 sec.

Method of Measuring Specific Heat

To study the phenomenon of heat loss and the variation of specific heat, Sir Dugald in 1904 devised a new method of experimentation already referred to. By it the actual working fluid behind the piston could be made to give information on these points during the process of explosion. A 14 x 22 in. single cylinder engine was used, and the exhaust and inlet valve levers were furnished with pins of extra length, so that the rollers on these pins could be moved into and out of the range of the cams.

A spring-and-trigger gear was arranged so that the rollers could be put out of range of the cams at any required instant. By this contrivance the engine could be run in its normal way in accordance with the Otto cycle at either light or heavy load, and any given explosion could be selected for the purpose of the experiment by operating the trigger at the proper moment. It was thus possible to run the engine at its normal speed under the usual propelling explosions, and to select at any given moment any particular charge, move the rollers out of the range of the cams immediately the charge entered, and so obtain an explosion and expansion stroke in the usual manner, with the usual charge. But both inlet and exhaust-valves were held closed and the charge was retained in the cylinder.

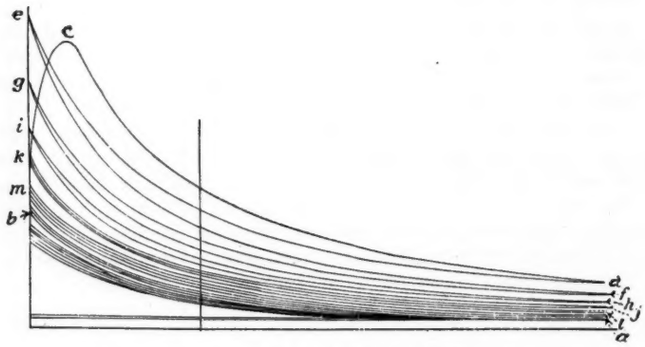


Fig. 1—Diagram of the explosion and alternate compression and expansion of hot gases in an internal-combustion engine cylinder.

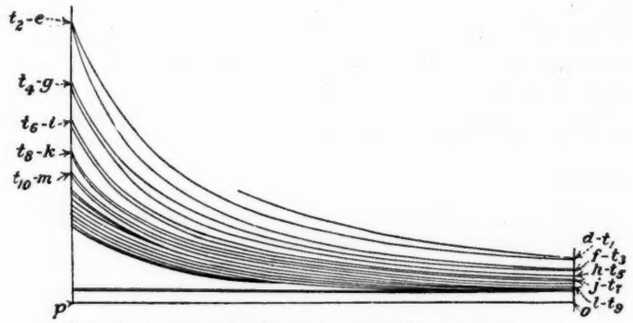


Fig. 2—A compression and expansion diagram with the explosion line omitted.

When the exhaust period was approached, the exhaust-valve remained shut, and accordingly the hot exhaust-gases were retained in the cylinder and compressed by the return stroke of the piston into the combustion space at the end of the cylinder. The energy of the flywheel was sufficient to keep up the rotations of the engine, with but little fall in speed during the short period of observation. The piston was thus caused to move to and fro, alternately compressing and expanding the hot gases which were contained in the cylinder.

An indicator-card taken from such an initial explosion and expansion and the subsequent series of compressions and expansions is given at Fig. 1; *a b* is the ordinary compression-line indicating the compression of the charge before explosion, *b c* is the usual explosion-line, and *c d* the usual expansion-line after explosion. At *d*, however, instead of the pressure falling to atmospheric by the opening of the exhaust-valve, as the exhaust-valve remains closed no escape of the hot products of combustion is possible, and accordingly the return of the piston produces the compression-line *d e;* the next outward movement of the piston produces the expansion-line *e f*, followed by the compression-line *f g;* expansion-line *g h;* compression-line *h i;* expansion-line *i j;* compression-line *j k;* expansion-line *k l*, and so on.

In Fig. 2 is shown the expansion and compression diagram without the explosion line. Referring to this diagram, the fall in temperature between *e* and *g* is not entirely due to cooling, which may be shown as follows: When the expansion *e f* takes place, the gases perform work on the piston equal to the area *e f o p;* when the compression *f g* takes place, the piston performs work on the gases equal to the area *f g p o*, so that more work has been performed by the gases on the piston than by the piston on the gases. Some work has therefore been done by the gases during the interval between points *e* and *g*. That is, part of the temperature difference t_2-t_4 is due to work done; it is not all due to heat lost through the cylinder walls. The difference between the two work areas is *e f g*.

If the specific heat of the gaseous mixture at the temperatures between t_2 and t_4 be known, then the temperature-fall due to the work-area *e f g* can be calculated, and when deducted from the total temperature-fall it gives the temperature-fall due to heat-flow through the cylinder walls. It is found that the specific-heat value need be only approximately known, as the temperature-fall equivalent of the work-area *e f g* is small in comparison with the total temperature-fall, and little error is introduced by a considerable error in the specific-heat value. This method enables a true temperature-fall curve to be drawn, showing the progressive fall of temperature incurred from revolution to revolution under the actual working conditions of the engine.

Proceeding in the manner described, Sir Dugald prepared cooling curves from the 14 x 22 in. engine under two conditions, viz. (*a*) without load, the cylinder kept cool and the engine running at 120 r.p.m.; (*b*) with full load, jacket at 160 deg. Fahr. and engine running at 160 r.p.m.

The cooling curves show the temperature fall due to heat loss, with mean temperature of the gases varying from 212 to 2732 deg. Fahr. and the exposure calculated to one second. Fig. 3 gives the temperature falls incurred per second for different mean temperatures, calculated in time. Curves *a a′* refer to no load operation at 120 r.p.m. with the cylinder kept cold by running water at 55 deg. Fahr. through the jacket. Curve *a* is for the complete stroke, while curve *a′* is for the first three-tenths of the stroke only. Curve *a* when prolonged to the zero of temperature fall cuts it at the temperature of 149 deg. Fahr. This

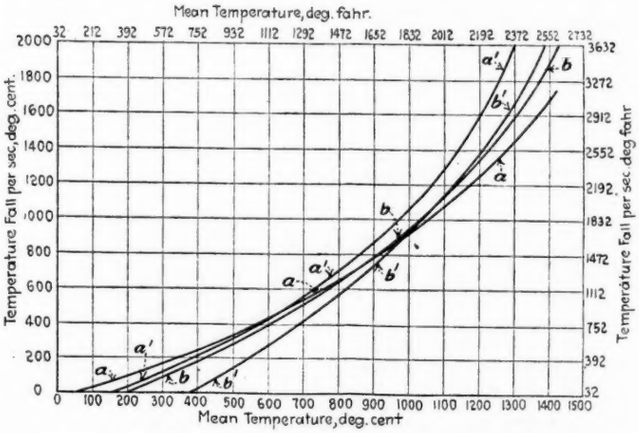


Fig. 3—Fall in temperature per second for different mean temperatures.

means that when the gases reach this temperature no further loss of heat to the cylinder wall takes place, and this therefore must be the mean temperature of the cylinder wall. This cylinder wall, of course, includes valve surfaces and piston head.

Curve *a′* when extended cuts the zero line at 329 deg. Fahr., which indicates that the mean temperature of the cylinder walls is much higher during the first three-tenths of the stroke than during the whole stroke. The curves *b b′* refer to full load operation at 160 r.p.m. with the jacket temperature at 176 deg. Fahr. As before, curve *b* is for the whole stroke and curve *b′* for the first three-tenths of the stroke. Curve *b* cuts the zero line at 374 deg. and curve *b′* at 752 deg. Fahr., indicating these to be the mean temperatures of the cylinder wall during the full stroke and the first three-tenths respectively.

From the curves of temperature fall given in Fig. 3 and specific-heat values of the gaseous contents of the cylinder, heat-losses can be calculated on the explosion-expansion line independently of any knowledge as to the completeness of combustion at any point, and for this purpose Sir Dugald determined the specific heat of the gases (Tables 2 and 3) in the following manner: If a gas be compressed without gain or loss of heat from volume V_0 to V_1, and the temperature rises from T_0 to T_1, the mean specific heat of the gas per unit volume at 0 deg. Cent. (32 deg. Fahr.) and a pressure of 760 mm. (29.92 in.) of mercury at constant volume between the two temperatures is

$$C_v = W \div [\Psi_0(T_1 - T_0)]$$

where

C_v = the mean specific heat
W = the work done upon the gas
Ψ_0 = a constant depending upon the quantity of gas in the cylinder

TABLE 2 — APPARENT INSTANTANEOUS SPECIFIC HEATS IN FOOT-POUNDS PER CUBIC FOOT OF WORKING FLUID AT 32 DEG. FAHR. AND 29.92 IN.

Temperature, deg. Fahr.	Specific Heat at Constant Volume, ft-lb.
32	19.60
212	20.90
392	22.00
572	23.00
752	23.90
932	24.80
1,112	25.20
1,292	25.70
1,472	26.20
1,652	26.60
1,832	26.80
2,012	27.00
2,192	27.20
2,372	27.30
2,552	27.35
2,732	27.45

TABLE 3 — MEAN APPARENT SPECIFIC HEATS IN FOOT-POUNDS PER CUBIC FOOT OF WORKING FLUID AT 32 DEG. FAHR. AND 29.92 IN.

Temperature, deg. Fahr.	Specific Heat at Constant Volume, ft-lb.
32- 212	20.3
32- 392	20.9
32- 572	21.4
32- 752	21.9
32- 932	22.4
32-1,112	22.8
32-1,292	23.2
32-1,472	23.6
32-1,652	23.9
32-1,832	24.1
32-2,012	24.4
32-2,192	24.6
32-2,372	24.8
32-2,552	25.0
32-2,732	25.2

This is true of expansion as well as compression. The dynamical value of the rise or fall of 1 deg. Cent. (1.8 deg. Fahr.) for 1 cu. ft. of the gas will be given by the formula:

$$D_v = W \div [V(T_1 - T_0)]$$

where

W = the work done on or by the gas in foot-pounds
V = the volume in cubic feet
D_v = the dynamical value in foot-pounds

From cooling curves determined during the actual operation of the piston in the gas-engine cylinder in the manner described, and the dynamic value of the temperature-falls at high and low temperature in foot-pounds per standard cubic foot of working fluid, calculated from specific-heat values, balance-sheets of the engine have been prepared from indicator measurements only. No gas measurements or determinations of heat-flow to jacket-water are required. A heat balance sheet taken from the 50 hp. engine running at full load is given in Table 4.

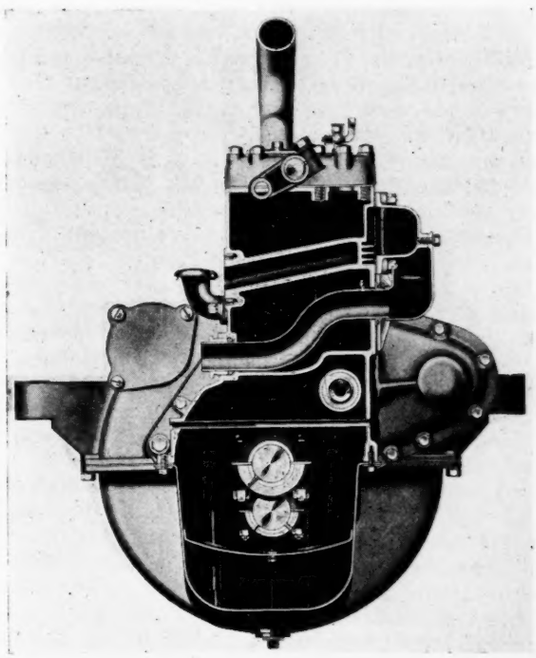
TABLE 4—HEAT BALANCE-SHEET

Card No. 22	Ft-lb.	Per cent
Heat-flow during Explosion and Expansion	12,480	15.4
Heat Contained in Gases at End of Expansion	39,800	49.0
Indicated Work	28,900	35.6
Total Heat	81,180 (104 B.t.u.)	100.0

If the combustion is nearly complete at the end of the stroke, the heat present found in this way should be equal to the evolved by the gas known to be present in the charge. The gas present in the charge is known to be approximately 0.183 cu. ft. at the working temperature of the measuring meter, and its lower calorific value was 574 B.t.u. per cu. ft. The heat of combustion of the gas is therefore $0.183 \times 574 = 105$ B.t.u. It is thus seen that the approximation is very close. The indicator has been able by the new method of application to account for the heat present in the charge.

Hot Air and Inlet Pipe on New Supreme Engine

THE accompanying photograph shows a sectional view of the new Model S-4 Supreme engine. In this engine the carbureter is located on the opposite side of the engine from the valves, and the arrangement of the hot air pipe from the exhaust manifold to the carbureter and of the inlet pipe from the carbureter to the manifold is rather neat. The inlet pipe is cast integral with the cylinder block. It extends across the cylinder block between the second and third cylinders and ends in the hot spot inlet manifold cast integral with the cylinder block. The hot air inlet tube is a bent pipe extending from the air heater secured to the under side of the exhaust manifold to the opposite side of the engine. Note the manner in which water-tight joints are made with the jacket walls. Another interesting feature is the control tube across the crankcase.



Arrangement of hot air tube and inlet pipe on Supreme S-4 engine

The Modern Motor Truck

THE construction and operation of all the leading tyes of gasoline and electric trucks are discussed in a detailed and practical manner by Victor W. Pagé in the 1921 edition of his volume entitled "The Modern Motor Truck." The book is designed for the use of truck owners, users and drivers and contains information of great value to the practical mechanic for use in his daily work. Pagé's work is too well known to readers in the industry to render necessary any detailed discussion here.

S. A. E. SUMMER MEETING

Flame Characteristics and Their Influence Upon Combustion

A paper which deserves study even if its application is not at first apparent. The analysis of factors controlling combustion and detonation and the means suggested for controlling these phenomena are considered.

By C. A. French*

THE present state of our knowledge does not permit of an exact scientific definition of flame, for the reason that it may be the result of either electrical, thermal or chemical action, or, perhaps, a combination of two, or all of them. Flame does not necessarily indicate combustion. The flames in the Moore tube, the Geissler tube or the mercury vapor lamp, do not arise from combustion; neither can their glow be attributed largely to thermal action. Solar protuberances, according to the common view, are gases whose glow is of purely thermal origin, but colorless gases in a tube cannot be made to glow by thermal action alone.

Combustion, either slow or fast, is not always accompanied by flame. Burning hydrogen and oxygen, if both are pure and dustless, make no visible flame even in the darkest room, according to the experiments of J. S. Stas. This is consistent with the fact that the line spectrum of hydrogen lies wholly within the ultra-violet. In the combustion of ethylene and chlorine the attendant radiation is below the pitch of visibility. In catalytic flameless combustion, which may begin with the hydrocarbon mixture and catalyst below zero fahr. and end 2000 to 3000 or more degrees above, there is no flame whatever, nor does the catalyst propagate flame even when surrounded by an excess of very rich combustible mixture. Surface combustion, which is entirely distinct from catalytic flameless combustion, may be regulated so as to show no flame, but that is on account of the very great luminosity of the white hot refractory surfaces back of the transparent blue flame. It will always cause a visible flame if an excess of mixture is supplied. The cause of transparent flames is doubtless largely electrical, while the cause of the opaque luminous red, yellow and white flames is probably almost entirely thermal.

A consideration of these facts will show the present impossibility of a strict definition. For the purpose of this paper, flames will be regarded as gases rendered temporarily visible by reason of chemical action; their physical rather than their chemical aspects will be discussed; and, unless otherwise indicated, it will be understood that only the flames of common gasoline and kerosene are referred to.

Many combustion phenomena can be explained only by the assumption that in normal blue flame the fuel burns from the molecule. In explosive combustion present-day gasoline and kerosene refuse to burn with an entirely blue flame under the conditions we use them. They burn with a very objectionable luminous sooty flame, which causes detonation and carbon deposits; while lighter fuels of the same general character burn in an inoffensive manner and give much higher thermal efficiencies. To gain a reasonably clear understanding of the requirements and characteristics of the different kinds of flames it is necessary to start with a study of atoms and molecules. Dr. Irving Langmuir says of atoms, "If a lump of ordinary matter the size of a baseball could be magnified to the size of the earth, the atoms in it then would have become about the size of baseballs." Atoms are believed to be composed of charges of positive and negative electricity. The positive electricity is concentrated into a very small particle called the nucleus, located at the center of the atom. The negative electricity exists in the form of electrons which arrange themselves in space around the nucleus. The electrons in different kinds of atoms are alike, but there are as many different kinds of nuclei as there are chemical elements. These differ from one another only in the amount of positive electricity they carry. For the simplest element, hydrogen, the nucleus has a unit positive-charge which is able to neutralize the charge of a single electron. Thus a hydrogen atom consists of the nucleus and a single electron. The next element, helium, has a nucleus with a double positive-charge, and the atom thus contains two electrons. Atoms of carbon have six and oxygen eight electrons. The electrons are not stationary but each revolves in its own orbit about a certain equilibrium position. It is thought that all atoms occupy about the same spaces.

As atoms are thought to be spherical, it is possible that molecules usually are of the same compact symmetrical shape; at least their behavior in combustion is best explained by this assumption. If we take any number of ½-in. balls less than 13, and arrange them in a symmetrical spherical form, it will be seen that none is entirely covered and cut off from contact with the outside. By taking the 13 balls it will be found that there is one ball in the center that is entirely surrounded. As we know that nature abhors a vacuum, we imagine that there is one atom in the exact center of any ordinary stable gaseous molecule. We find that by starting with one ball, or atom, in the center we can arrange 12 more around it so that all of the 12 will touch it. The arrangement will be symmetrical and the group will resemble a sphere. As there is no other equally symmetrical arrangement of spheres it is reasonable to assume that 13 atoms are the nucleus for any larger number. Hexadecane, $C_{16}H_{34}$, the largest molecule usually found in kerosene, has 50 atoms. Such a molecule would be likely to have 13 atoms inside and 37 on the outside. While 37 atoms would not quite symmetrically cover the 13 inside ones, if all of the atoms were rigid and unyielding, still there would perhaps be enough elasticity to the whole

*Paper presented at the semi-annual meeting of the Society of Automotive Engineers.

mass to allow the outside to be fairly symmetrical; there would therefore be three layers of atoms in such a molecule.

Molecules are thought to be vibrating and rather reacting on one another as they come near each other at rates depending upon their temperatures. In a mixture of combining proportions of air and fuel molecules the molecules of fuel, nitrogen and oxygen could bombard each other for days without starting oxidation, as it seems that some forms of chemical action between molecules are impossible. We know that two atoms, or one molecule, of hydrogen unite with one atom, or one-half molecule, of oxygen, and that one atom of carbon unites with first one atom of oxygen and the carbon monoxide formed by this union later unites with one more atom of oxygen. In other words a hydrogen molecule is satisfied with an oxygen atom, while a carbon atom requires an oxygen molecule but it can only use half of it at a time. It seems certain that the oxygen must be dissociated and ionized before combustion can begin. It is known that the radiation of a hydrogen flame is entirely in the ultra violet; that ultra violet rays dissociate and ionize oxygen; that oxygen ions spontaneously ignite many organic substances. Other means of producing oxygen ions will be discussed later, but as the blue flame of the electric spark we use for ignition is sufficient to ionize oxygen we are now ready to start the combustion of a 50-atom fuel molecule.

Beginning of Combustion

The electric spark ionizes enough oxygen to start the combustion of some one or more of the 37 atoms on the outside of the molecules. The ultra-violet rays from the burning of the first atoms ionize enough oxygen for the next few atoms but evidently not much more, for the blue flame never "runs away" or causes detonation as it would likely do if there were a large excess of ions. During the combustion of the outside layer of the molecule each atom is being bombarded by molecules of nitrogen and molecules and charged ions of oxygen. As the fuel atoms burn they send out new molecules of water and carbon dioxide, two first-class commercial fire-extinguishers, to replace the oxygen with which they united. If we imagine the atoms in the outside layer of the molecule to be about $C_{12}H_{25}$, there would be 24½ new molecules of carbon dioxide and water to replace the 24½ molecules of oxygen used. The flame during the entire combustion of the outside layer of atoms is the perfectly unobjectionable transparent blue flame of almost entirely electrical properties with which every housewife is familiar from long use of it in the gas range or blue-flame oil-stove.

When this combustion started, assuming that there were no burned gases present from a previous explosion, each fuel molecule was surrounded with 125 N_2, and 33 O_2, but when the 37 outside atoms have burned away we find 125 N_2, 12 CO_2, 12½ H_2O and only 8½ O_2. It would be extremely difficult, if not impossible, to propagate a flame in a cold mixture of these proportions. A hydrocarbon flame cannot be propagated in an atmosphere containing less than 17 per cent of oxygen. With 149½ other molecules in the way, all of them the very best kind of fire-extinguisher, the 8½ molecules of oxygen must have considerable time if they are to reach the remaining fuel atoms. In the meantime the 13 inside atoms have been subjected to the full flame temperature in the absence of air. If heated sufficiently in the absence of air all hydrocarbons will dissociate into hydrogen and lamp black. Probably some of the atoms immediately recombine into much smaller molecules; conditions at this time favor the formation of very small, highly endothermic hydrocarbons, such as acetylene C_2H_2; but in any event there is much free hydrogen and free carbon.

Free carbon atoms tend to form aggregates of tangible size, far too large to burn quickly, among which the free nascent hydrogen burns, heating them to incandescence. The flame now becomes first red, next yellow, then intensely luminous, opaque and radiant. The interstices between the solid carbon particles act as miniature refractory-lined reverberatory furnaces in which the free hydrogen is burned, thereby raising the temperature of the burning mass several hundred degrees. When the flame was in the stage of burning the outside layers or the blue stage only about 8 per cent of its energy was in the form of radiant heat; now more than 30 per cent of it is radiant.

When dissociation or cracking occurs at high temperature there is a large production of charged ions of probably all constituents of the mixture. A pressure wave, per se, probably could not be made to travel through molecular air in excess of the velocity of sound but charged ions undoubtedly greatly exceed that velocity. We will imagine that by this time one-quarter of the mixture is inflamed. The flame-front is still blue but the flame around the spark-plug, having been ignited first, has burned off the outside layers of the fuel molecules and has, by reason of the dissociation of the inside layers, arrived at the white-flame stage. Radiant heat with the velocity of light, and charged ions at something greater than the velocity of sound, are being sent out by the white-flame spot. The transparent blue-flame area between the flame-front and the white spot offers no resistance to the radiant heat and probably not very much resistance to the passage of the ions.

The vapor of hexadecane ($C_{16}H_{34}$) is very dense and opaque as the molecules are very large. Radiant heat is incapable of heating transparent vapors or gases, but it is absorbed in great quantities by a vapor as opaque as that of hexadecane. Heavy-hydrocarbon vapors when subjected to radiant heat of a moderate temperature will crack into smaller hydrocarbons when the cracking is done in the presence of enough air or neutral gas, but if subjected to radiant heat of a high temperature, if in the presence of air, they will ignite as they crack. Neither the radiant heat nor the charged ions can penetrate the dense cloud of vapor beyond the flame-front to a very great depth, but between them they instantly crack some of the molecules and ignite a very large quantity of highly compressed unburned mixture. This action causes a sudden severe increase in pressure, which, on a time and pressure diagram, shows a high peak occurring some little time after ignition.

This new flame very soon reaches the white-flame stage and causes perhaps another auto-ignition of a still more remote portion of the unburned mixture, causing a second pressure-peak. The more opaque fuel molecules would show a greater number of auto-ignitions or pressure peaks than those of less opacity. It is easy to imagine that if a cylinder were large enough the pressures and temperatures would ultimately accelerate auto-ignition to a detonative rate of burning. Auto-ignition is often seen in forest and prairie fires where ignition occurs ahead of a flame-front when there is no possibility of sparks being carried to the area ignited. In experiments with burners auto-ignition is often seen when opaque vapor becomes ignited from a white flame some distance away with which the unignited vapor has no connection. There is little probability that a pressure wave causes auto-ignition as it would simultaneously ignite the whole body of unignited mixture, and we know that kerosene, for example, usually gives three pressure peaks, fuel oil five, etc., which seems consistent with the differences in the opacity of their vapors. There is no doubt that acetylene is occasionally formed and detonated. A glass window in the cylinder of a detonating engine on rare occasions shows a flash that is much more blinding; the noise is much louder than the ordinary detonation. Apparently this happens only with rich mixtures and an early spark.

It should not be imagined that the rate of oxidation increases after a dissociation, for such is far from being true. The rate of *inflammation* increases very considerably, but a careful study of the mixture proportions and ingredients after dissociation occurs will show that further oxidation, of the carbon at least, cannot be otherwise than a very slow process. Rich mixtures and unvaporized fuel greatly aggravate our combustion troubles. Inasmuch as it is positively known that hydrogen and carbon require definite quantities of oxygen for their combustion, it is not likely that we will ever be able to use rich mixtures, as we now use them, without undesirable complications. Unvaporized fuel has little opportunity to burn in a normal manner, as by the time it is vaporized and ready to burn the oxygen supply is much depleted and the dilution with burned products makes it exceedingly difficult for the oxygen to reach it in time to oxidize any of it before dissociation occurs.

Inoffensive Combustion

Having studied a very inefficient type of combustion, we should now study the requirements and characteristics of the inoffensive variety. It should be understood that unless complete dissociation occurs immediately previous to ignition, any kind of a visible hydrocarbon flame cannot be propagated without an initial area, or period, of transparent blue flame, in which the air and fuel are in explosive proportions. Whether the fuel is burned in a supporting atmosphere, as a homogeneous explosive mixture, or even in a complete inversion of combustion, i. e., the burning of air in an atmosphere of fuel, makes not the least difference with the flame characteristics of color in the initial area or period. Entirely green, lavender, red, yellow or white flames cannot be propagated except as above stated, nor can they be maintained if too widely separated from transparent blue flame. If a yellow flame is examined through a yellow color-screen, it will be found to be permeated with a thin blue flame, and if a supporting atmosphere is available it will be seen that the yellow spot is entirely surrounded by blue flame. This is also true of spots of green, red and white when examined through the proper color-screens. In the oxidation of stable fuels spots of green, red, yellow or white indicate either a temporary or a permanent lack of oxygen, and the fuel atoms that actually cause spots of those colors are not at that instant burning. Hydrogen makes no visible flame; nor does carbon in burning to carbon monoxide; carbon monoxide usually burns with a transparent blue flame; therefore, a transparent blue flame is the only *visible* sign of oxidation. Spots of any other color indicate the cracking of the fuel into new smaller hydrocarbons and the large production of carbon monoxide, or the complete dissociation into free carbon and free hydrogen.

In the blue flame the reactions are simpler, more complete and the flame is more compact than any other. The molecules are in more rapid vibration and the oxidation is completed in much less time than when dissociation occurs. It has only about 8 per cent of its energy in the form of radiant heat, it is incapable of depositing soot, and its progress is not seriously affected by contact with cold surfaces. The only known requirements of blue flame are enough air and a fuel that will remain in the molecular state until fully oxidized. Nearly all liquid and gaseous hydrocarbons can be burned with an entirely blue flame, but, beginning with molecules of 12 atoms, more time for the burning must be given as the molecules become larger. Leaving out the ethers, the acetylenes and a few other hydrocarbons that are incapable of burning without more or less explosive dissociation, it can be said that any fuel molecule of 12 atoms or less will burn with an entirely blue flame under any pressure so long as there is no excess fuel.

There is, of course, what might be called a gradual decomposition of the fuel molecule even in a normal blue flame. Products of a limited oxidation of kerosene by catalytic flameless combustion are composed of a large number of alcohols, aldehydes, acids, and saturated and unsaturated hydrocarbons. In the green area of the Bunsen flame there is a very great amount of cracking into new molecules, but so long as complete dissociation does not occur the flame does not become luminous. In the so-called wickless blue-flame kerosene-stoves small jets of air are burned in an atmosphere of kerosene vapor until the fuel molecules are cracked down so small that they will burn above the stove in a supporting atmosphere without luminous flame. It is apparently impossible to produce complete dissociation when enough air or neutral gas is present.

Fuels of the benzol series can seldom be made to burn explosively with a white flame unless a great excess of fuel and very high compressions are used. They can be caused to dissociate and make a cloud of black fluffy carbon, but as benzol series molecules are all small, they do not dissociate until practically all of the oxygen is used; there being very little oxygen left after dissociation, the free hydrogen usually cannot burn enough to heat the carbon particles to incandescence. Used in stoichiometrical proportions such fuels probably cannot be made to detonate under any pressure. Fuels of the saturated series, when used in excess, have more tendency to become luminous; they are almost certain to have some large molecules as they are nearly always a mixture of a large number of different members of the series.

For every fuel molecule larger than 12 atoms there is a rate of oxidation that will cause it to dissociate, but for use in present explosive engines a molecule of 20 atoms or less would burn fast enough to be perfectly satisfactory, provided that there were no highly endothermic bonds in it. Its vapors would be so nearly diathermous that they could not be much affected by radiant heat. Fuels having the largest molecules have the most opaque vapors. The large molecules cannot burn rapidly without dissociation. The excess of ions from the dissociation and the radiant heat from the incandescent free carbon particles cause autoignition in unignited portions of the mixture. Therefore, to burn heavy fuels with a blue flame in present engines, one or all of the following remedies should be used:

(1) Thoroughly vaporize fuel
(2) Retard speed of oxidation
(3) Crack opaque vapors before ignition by use of radiant heat
(4) Raise compression and use reasonable excess of air
(5) Ionization previous to ignition
(6) Induce great turbulence
(7) Destroy reverberatory action of combustion-chamber walls
(8) Eliminate pockets in the combustion chamber
(9) Locate spark-plug in exact center of combustion-chamber

Oxidation and Flame Propagation

Oxidation can be retarded by careful cooling of the combustion-chamber, and by the use of plain diluents such as an excess of air or cool exhaust gas. The compression should be high, 125 lb. or more, to gain in thermal efficiency. The diluents can then be used with more effect and economy than when the dilution is secured by lowering the compression. It might be worth while to try a very small amount of chlorine as a diluent, as this substance is an ionizer and whenever a hydrogen atom is freed from a molecule, leaving the molecule in an unstable equilibrium, the chlorine would be likely to replace the hydrogen and preserve the molecular structure.

To best promote flame propagation the oxygen might be

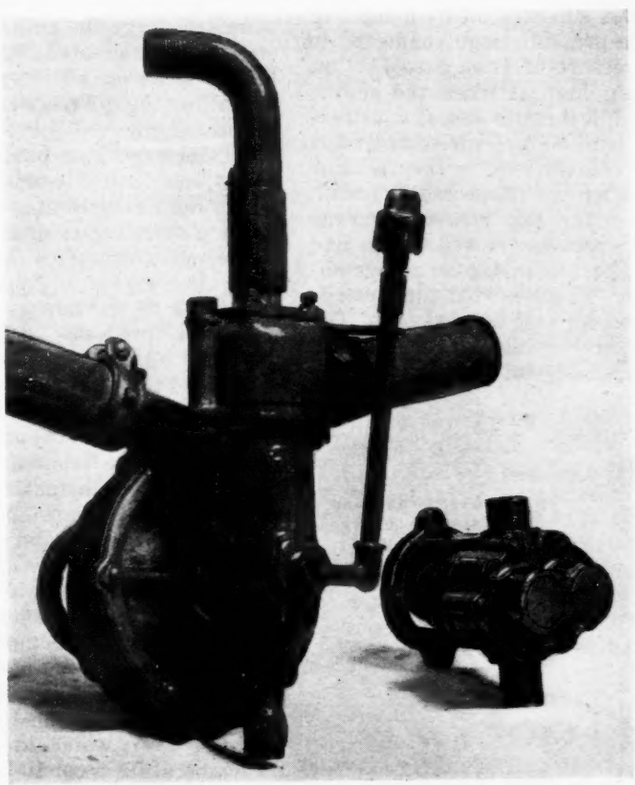
(*Continued on page* 1123)

A New Method of Cooling Automotive Engines

Normal temperature of jacket is raised above the boiling point of water by using a closed system in which steam is generated at about 5 lb. per sq. in. pressure. Radiator not completely filled with water.

By P. M. Heldt

THERE has been very little progress in cooling systems for years past, aside from the introduction of the thermostat, which is designed to ensure quick warming up of the engine when starting from cold and maintaining a fairly constant jacket temperature thereafter. The necessity for quickly heating up the engine and for maintaining it hot irrespective of load changes arises from the low volatility of our present fuel. There is no doubt that the higher the cylinder wall temperatures, within the limit at which trouble begins to be experienced from preignition or burning of the lubricating oil, the more rapid and complete the combustion of the fuel, and the less the trouble from crankcase oil dilution. Air cooling, of course, affords these higher cylinder wall temperatures, but the great majority of engineers seem disinclined to tackle the problems involved in the development of a successful air-cooled engine.



Centrifugal pump and thermostat (left) of Cadillac car and gear pump (right) which Mr. Rushmore substituted for these parts

Samuel W. Rushmore, well known to the automotive industry as a former manufacturer of searchlights (headlights) and of an electric starting and lighting system, has recently developed a cooling system which is in a way intermediary between the air cooling and the ordinary water cooling systems. Water is used as the cooling medium, but the jacket outlet temperature is constantly maintained above the boiling point of water. There is ordinarily little or no water in the radiator above the bottom tank. The radiator core is filled with steam to a certain height depending upon the relation between heat absorption in the cylinder jackets and heat dispersal per unit of core surface. It is obvious that the radiator becomes much more effective with a cooling medium at 220 to 240 deg. on the inside of the core than with water at from 100 to 200 deg., especially at high atmospheric temperatures.

The great practical advantage of the new system, and which should ensure for it a wide field of application, is its simplicity. Imagine an ordinary water cooling system with pump circulation and having a thermostat in the top connection between jacket and radiator. The thermostat is removed and the connection to the top tank of the radiator eliminated. The outlet from the jacket is connected to the bottom tank of the radiator, the radiator overflow pipe is provided with a blow-off valve set to about 5 lb. per sq. in. and the centrifugal pump is replaced by some type of positive pump. (Mr. Rushmore has so far used gear pumps.) The bottom tank of the radiator is preferably enlarged in size. This completes the system.

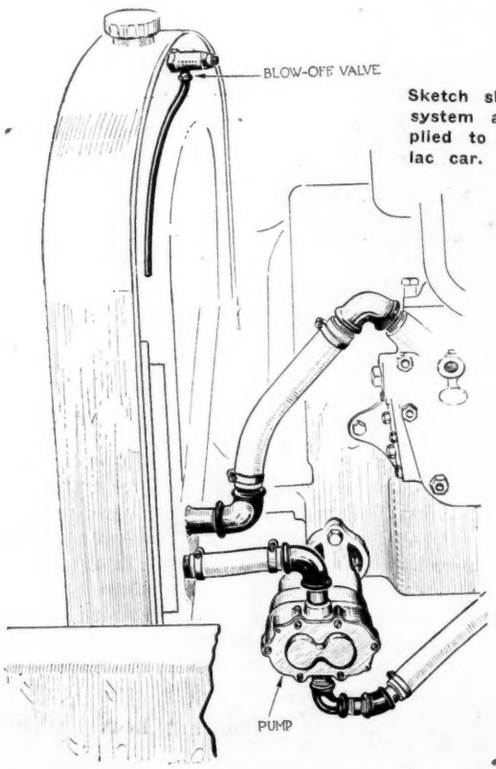
Even though the thermostat is removed, the same advantages are obtained as with the ordinary system with thermostat, because when starting a cold engine there is no circulation of the cooling fluid through the radiator, and the engine therefore quickly approaches its normal working temperature. In fact, the cooling action of the radiator core begins only when the water leaving the jacket reaches the boiling point. This very fact also insures a nearly constant temperature throughout the operating range because the maximum temperature in the system cannot greatly exceed the boiling point, as it is limited by the setting of the blow-off valve, and as soon as the water outlet temperature drops below 212 deg. the cooling action ceases almost entirely, so even at very light loads the water outlet temperature is constantly above 212 deg.

Mr. Rushmore has applied the system to a number of cars, including a Cadillac, a Crane-Simplex, a Studebaker, Mack 5½-ton truck and a Locomobile. The Crane-Simplex is fitted with thermometers and pressure gages for test purposes. A pressure gage of the Bourdon tube type is connected to the engine jacket outlet, as is also a thermometer of the circular dial type, the dial being mounted

on the toe-board. A mercury column pressure gage is connected to the top of the lower tank which has a nipple soldered to it on the forward side, over which the end of a rubber tube is slipped.

Ordinarily only the lower tank is to be filled with water, and to this end it is provided with a filler spout centrally in front, but to show that no harm would result if a driver unfamiliar with the system filled the radiator to the top, Mr. Rushmore did this and then started on a drive, accompanied by the writer. The thermometer showed a rather rapid rise in temperature at the jacket outlet, and after some time cold water began to escape through the blow-off valve. Thereupon the engine was shut down, and this greatly hastened the expulsion of the surplus cold water, no doubt because, when the fan is stopped, the cooling action is greatly reduced and the heat stored in the piston and other metal parts of the engine is transferred to the cooling water and generates steam. Owing to the use of a positive pump, circulation stops completely when the engine is shut down, and the generation of steam in the jacket manifests itself in blowing off all water in the radiator core.

The car was driven a considerable distance over a variety of roads, the route followed including one long hill with grades up to 18 per cent, and the system appeared to work very satisfactorily under all conditions. Most of the time a large part of the radiator was screened off by a sheet of pantasote in front of it. The pressure gage connected to the jacket outlet showed a pressure of from 5 to 7½ lbs. per sq. in., the pressure being highest when the engine had run for some time under full throttle and at considerable speed. The water outlet temperature varied from 230 to 240 degrees. The pressure conditions in the radiator were apparently quite independent of those in the jacket, the pressure shown by the mercury gage connected to the bottom tank varying roughly between plus 3½ lbs. and minus 3 lbs. per sq. in. Thus here is under certain conditions a vacuum in the radiator. To show what these conditions are the following experiment was carried out. The engine was run for a while at considerable speed with practically the whole of the radiator core screened off by the pantasote, so that the radiator filled with steam practically to the top and showed considerable pressure. The screen was then entirely removed and the car driven down an incline where very little power was required and consequently very little heat was absorbed by the jacket water. The mercury column very soon showed a vacuum in the radiator, while pressure above atmospheric continued at the jacket outlet.



Sketch showing system as applied to Cadillac car.

This difference in the pressures of the jacket and radiator indicates that the pressure shown by the gage connected to the jacket outlet is largely due to the friction head in the pipe leading from the jacket outlet to the bottom of the radiator. The pressure in the cooling circuit naturally will vary slightly from point to point and the pressure at any particular point will depend upon three factors. There is first the pressure due to the static head, which is nil at the highest point in the circuit, a maximum at the lowest point and varies uniformly with the distance between the two points. Then there is the pressure due to the friction head, which is nil at the inlet to the pump and increases around the circuit to the outlet of the pump in a non-uniform manner depending upon the sectional area of the water passage. Finally there is a pressure due to the temperature of the water, which is the same at all points of the system. To make this plain, assume that there is no circulation. Then if any part of the water is raised above the boiling point, steam will be generated and pressure created, but the pressure per unit area will be the same on all interior walls of the cooling system, except for the difference due to the effect of gravity on the water.

As the small gear pump employed delivers to the engine jacket less than one-tenth the volume of water necessary where the heat is transferred to the radiator by the usual water circulating system, the return pipe from the jacket to the radiator carries chiefly steam, with which is carried along the excess or unevaporated water, and thus the resistance to the flow is somewhat greater than if water alone were present. On the Cadillac, on which the system has been applied, the outlet pipe is much larger in proportion to the size of the engine, so that the friction head never exceeds ½ lb. per sq. in. Although, by making the steam outlet pipe of proper diameter and by avoiding sharp bends the friction head need not exceed ½ lb. per sq. in., it has been found that at the lowest engine speeds the centrifugal pumps usually employed will not give even that much pressure and therefore a positive pump is required to insure proper circulation at idling speeds. This is the only reason a positive pump is required, and not the pressure due to the temperature of the water, as this pressure is equal at the pump inlet and delivery sides and does not affect the working of the pump.

Only a comparatively small pump is needed, for the reason that in this system the heat absorbed by the jacket is used to convert water into steam, instead of merely raising its temperature from 10 to 20 deg. The latent heat of one pound of steam is 966 thermal units, whereas the heat required to change the temperature of one pound of water 20 deg. Fahr. is only 20 thermal units. Hence it would seem that with this system the water needs to be circulated only one-fiftieth as fast as with the ordinary system. However, extreme conditions must be provided for and we have no assurance that a temperature gradient of 20 deg. in the ordinary system will take care of extreme conditions; besides, it is not safe to figure on all of the water being vaporized during each round, which would mean that only steam would pass through the return pipe. Therefore, while a much lower rate of circulation is permissible than with the ordinary system, it would not be safe to cut down the circulation in the proportion above mentioned.

One feature of the new system about which there was

some uncertainty at first was the ability of the condensate to descend in the very narrow passages of the radiator core when steam is constantly passing upward. This, however, has caused no difficulty whatever. The lower part of the radiator core is constantly filled with steam which is being condensed by the cooling action, while the upper portion of the core is absolutely cold. There is usually a sharp line of demarkation between the hot and cold sections, this line rising and dropping with the conditions of engine operation. The upper part of the radiator is filled with air and water vapor which is normally under a slight pressure. This is a fortunate thing, because if the radiator were filled with steam to the top, if the driver removed the radiator cap in a careless manner, he might possibly scald his hands.

In the earlier experiments Mr. Rushmore ran a pipe from the inlet to the bottom of the radiator part way across the tank, this pipe being drilled with a considerable number of small holes in the bottom and sides, with the idea of separating the water from the steam without forcing any of the water into the passages of the core. It was found, however, that this precaution was unnecessary, and he now employs only a simple pipe connection to the lower tank.

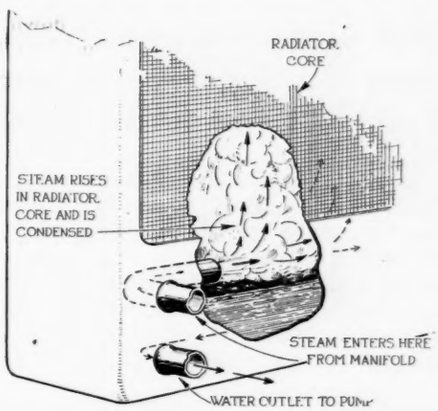
That neither the splashing of the water in the lower tank nor the returning condensate cause any noticeable obstruction to the upward flow of the steam is accounted for by the fact that with an air-cooled radiator the amount of steam condensed per minute per unit of cooling surface is extremely small. In the case of the Cadillac, the maximum evaporative effect at full load is only about one pint of water per minute which, divided among the 150 vertical tubes in the standard Cadillac radiator, amounts to only a few drops of returning condensate per minute per tube, and in any type of air-cooled radiator the flow of steam is so slow that the condensate merely trickles downward without interference. In fact tests with a radiator fed with steam from a stationary boiler and cooled by a powerful electric fan have shown that even though excess steam be forced out of the top of the radiator, none of the condensate appears at the top.

So far the system has been adapted only to existing cars, and therefore probably has not worked under as favorable conditions as would be possible on a car specially designed with it. As to its advantages, there can be no doubt that it ensures more complete combustion of the fuel, especially at small engine loads, and tends to minimize crankcase oil dilution. It is simpler and cheaper than other systems, and ensures a quick heating of the engine to the normal working temperature and a fair regulation of that temperature. The danger of the fine passages of the radiator becoming clogged with deposits from limy water is eliminated, and owing to the much greater cooling effect of a unit radiating area when in contact with steam than when in contact with water at the normal jacket outlet temperature, probably a much simpler and more robust core construction could be used, or the depth of the core diminished.

No stock cars are as yet being fitted with the system, but it will probably be applied to a number of 1922 passenger car models. It is particularly applicable to motor trucks, for it tends to reduce crankcase dilution due to the engines running idle for long periods in cold weather. On the Mack truck above referred to a considerable saving in fuel was shown and, by reason of the higher radiator temperature, the system provides ample cooling capacity, even in mountainous country where the boiling of the water in the ordinary system often greatly reduces the working capacity.

A further important advantage over thermostat control is that as the radiator core contains no water it cannot freeze when on the road, as often happens unless a large percentage of alcohol is employed. Manufacturers employing the thermostat control advise customers to cut the thermostat out during freezing weather, the very time automatic temperature control is most needed. Several cars equipped with the Rushmore system were in constant service all through the past winter and gave no trouble from freezing.

As the temperature of the jacket water will depend upon the steam pressure carried, an inexpensive reducing valve



Sketch showing location of radiator inlet and outlet in Rushmore system.

may be put in the pipe leading from the jacket to the radiator to hold the jacket temperature constant at all loads regardless of the percentage of alcohol that may be employed to prevent freezing when the car is left standing for long periods in cold weather. With the present-day water cooling system using alcohol the maximum temperature cannot much exceed 175 deg.

The motometer is now connected to the engine jacket direct with dial on dashboard where it can be seen more easily and particularly at night and where it is not so easily stolen.

The new system should be of particular value on airplanes. Airplane radiators are now mostly of the hexagon tube type. It has been found that with the steam system the tubes can be placed much closer together, thus effecting a reduction of fully 20 per cent front end area for the same amount of air cooled surface. As the cooling effect per unit of cooling surface is from 50 to 80 per cent greater with steam, the area may be still further reduced, and in consequence of the saving in weight of water, additional fuel may be carried and the speed of the plane increased.

A Wire Wheel with Bolt Attachment

THE popularity of the bolt attachment for demountable wheels in Great Britain has induced the Dunlop Company to introduce a fitting of this kind for their wire wheels. The center of this wheel has a drum of pressed steel from which the usual wire spokes lead to the tire rim. The drum is secured to the hub by means of six studs and nuts in accordance with the usual arrangement of this principle of fixing. It thus eliminates threaded hubs and special locking devices for the wheel nut of the usual type. It is claimed that this arrangement not only simplifies the form of attachment and thus recommends it to the user, but it also represents a cheaper form of construction. In appearance, however, it suffers as compared with the usual type, for the central drum gives it a somewhat heavy appearance by comparison.

S. A. E. SUMMER MEETING

Developing a High Compression Automotive Engine

This summary describes some of the problems involved in the development of a Diesel type automotive engine. Particulars given apply largely to factors involved in design and construction of the fuel injection system.

AN S.A.E. Summer Meeting paper prepared by Fred C. Ziesenheim, bearing the above title, naturally divides into three parts. The first relates to the fuel problem, giving the proportion of gasoline, kerosene, gas and fuel oil and lubricating oil produced from crude petroleum in 1920, the change in the distillation curve of gasoline from 1915 to 1920, and the variation in the prices of crude petroleum and its distillates from 1913 to 1920, etc.

In the second part all present internal combustion engines are divided into three classes, low compression, medium compression and high compression. The first class includes all automobile engines, the second class the hot bulb, surface combustion or semi-Diesel engines, and the third group the Diesel engines. The advantages and disadvantages of each class are given.

In the third part Mr. Ziesenheim describes some development work on mechanical injection systems for high compression engines which he has done at the Mechanical Laboratory of the Carnegie Institute of Technology. A small surface-ignition engine was used, after increasing the compression-pressure to 500 lb. per sq. in. by the substitution of a new piston and a new cylinder-head. The engine is a vertical two-stroke-cycle two-port type, with crankcase precompression. The bore is 5½ in. and the stroke is 6 in., which is reduced to 4¾ in. by the width of the ports. The compression of 500 lb. per sq. in. was selected for the initial tests, as it can be decreased when desired by simply raising the cylinder-head. The compression necessary for auto-ignition depends upon the ignition temperature of the fuel; the temperature from the compression must be high enough to insure starting with the engine cold. The lowest compression that will permit cold starting is about 350 lb. per sq. in.

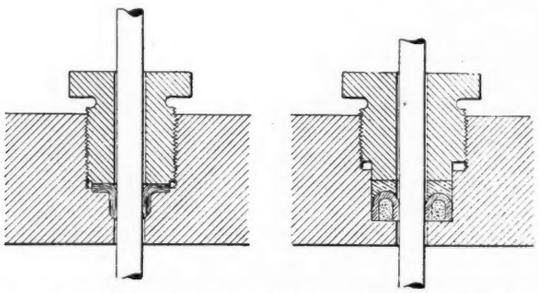


Fig. 1—Two types of leather valve packing, the packing at the left is of the flange type while that at the right is what is termed a U-packing.

Ignition temperatures of fuels as applied in engines cannot be satisfactorily determined by ordinary laboratory equipment, as the manner of injection and the temperature of the cylinder walls are not considered. Apparatus consisting of a combustion chamber fitted within a gas furnace and equipped with an injection valve, and pressure, temperature and time recording devices has been used by the British Admiralty Experimental Laboratory for determining the ignition temperatures and the time interval between the moment of injection and the moment a pressure rise is indicated in the combustion chamber.

Mechanical injection can be accomplished by variable pressure, in which the fuel injection valve opening is controlled by fuel pressure difference; or by constant pressure, in which the fuel injection valve opening is controlled mechanically by means of a cam and lever and the fuel pressure is constant.

The variable type of compression valve consists of a spring-loaded differential plunger that opens when the fuel pressure exceeds the spring resistance. The fuel pressure variation producing injection is independent of the action of the fuel pump and governor, which action should cause the injection to take place in accordance with the conditions insuring optimum pulverization. In addition, the quantity of fuel to be injected must be metered accurately, and the time and duration of injection must be under control. The small quantity of fuel to be injected before each working stroke is responsible for some of the principal problems in the design of a small high speed engine. In the experimental engine under discussion the quantity of fuel injected per revolution at full load is about 0.1 cc.

By the usual method of metering the fuel, the governor holds open the suction valve or a by-pass valve during the initial portion of the pump stroke and, upon the closing of the valve, the fuel is pumped into the injection valve. Another method consists in varying the stroke of the pump plunger by a wedge which is actuated by the governor. With accurate metering by the fuel pump the problem then consists in discharging exactly the desired quantity of fuel from the injection valve, and in discharging uniform quantities of fuel for uniform speed and load conditions.

Conditions which may interfere with or prevent the injection of the metered quantity of fuel are the (a) elasticity of the fuel, (b) elasticity of fuel-containing system, (c) elasticity of entrained or entrapped air and (d) leakage within the fuel system. The elasticity of the fuel at the pressures used is approximately 2 per cent. This makes it necessary that the quantity of fuel in the system, between the pump and the ignition nozzle, be the least possible.

To overcome elasticity in the fuel containing system it is obvious that the fuel pipes, connections and the like must be made heavy enough to insure absolute rigidity. The poor injection action of many surface-ignition engines can be attributed to failure to meet this condition. Air gets into the fuel system by being entrained with

the fuel, by leakage past the injection valve during the compression stroke and by leakage during the suction stroke of the fuel pump. It is sometimes entrapped during the assembly of the fuel system, or it can accumulate while the engine is idle. Air is so highly elastic that a small bubble in the fuel system will become a minute volume during the working stroke of the fuel pump but, when the pump starts on the suction stroke, the bubble expands and prevents the pump from drawing in a full fresh charge of fuel. During the following working stroke of the pump either no fuel will be discharged or the quantity will be less than that desired. This produces an erratic "hit and miss" injection action that may cause the injection of an excessive quantity of fuel, thereby producing abnormal pressures in the cylinder. Provision must be made for draining the air from the highest point in the fuel system, preferably in the injection valve. The fuel system must be arranged so that the air will not accumulate at any other point.

The quantity of fuel in the system, particularly in the injection valve, should be a minimum in order to secure as complete and rapid a discharge of the fuel and entrained air as possible. Fuel leakage occurs around the pump plunger packing gland and around the packing gland or similar device of the injection valve stem. High pressure packing glands are a source of trouble. A form of plunger packing used with satisfaction in hydraulic machinery at pressures exceeding that encountered in injection engines is shown in Fig. 1 and consists of Vim leather molded into the shapes shown. In the flange packing at the left the nut clamps only the flanged portion; the body of the packing has clearance so that the liquid can surround and force it tight on the plunger. In the U-packing at the right the pressure of the liquid within the U forces the leather against the plunger and the walls of the receptacle, thus sealing the joint. The space within the U can be filled with hemp to prevent collapse of the packing when there is no pressure acting. Leakage may occur at the suction or discharge check-valves, which are usually placed in multiple. Poppet, cylindrical and ball-check valves are shown in Fig. 2.

A form of pipe connection used satisfactorily in Diesel engine practice is shown in Fig. 3. The male part is made of brass or copper, the tubing being brazed into it.

The simplicity of the injection valve is the advantage of the variable pressure method; the operation of the valve is entirely automatic, avoiding the complication of valve-gear. The quantity of fuel for each charge can be metered accurately by simple and reliable mechanism incorporated within the fuel-pump, but the disadvantage of the method lies in its inability to discharge the desired quantity of fuel at the correct time and in the manner necessary for achieving complete combustion. The reasons for this inability have been enumerated. Of these (*a*) the elasticity of the fuel and (*b*) the elasticity of the fuel-containing system can be partially obviated by proper design, but (*c*) the elasticity of entrained and entrapped air and (*d*) leakage within the fuel system are more difficult to control. Due to the small quantity of fuel to be discharged the presence of any air will interfere with or prevent regular injection of the fuel, and a very slight

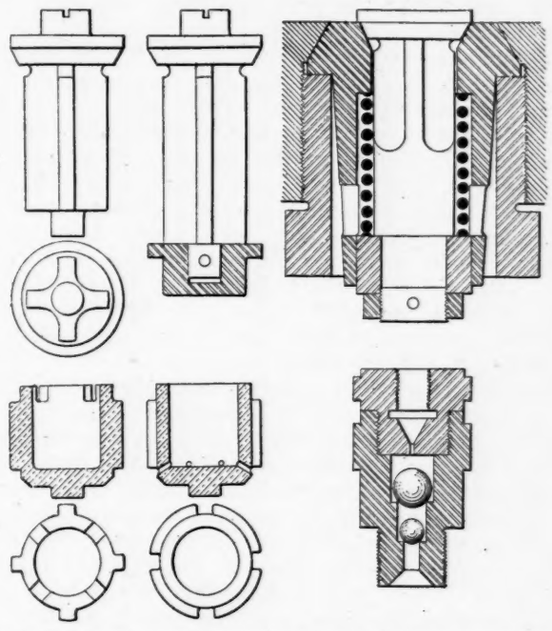


Fig. 2—Types of poppet, cylindrical and ball check-valves used in internal-combustion engines

leakage can easily equal the quantity of fuel it is desired to inject. These adverse conditions make the variable pressure method practicable only for large slow speed single-cylinder engines, where the amount of fuel to be injected is a relatively large quantity. The method is in use on all surface ignition engines and is therefore to be found on many high compression engines developed by companies building both types. The high compression engines using this method are usually of the slow speed single-cylinder type, which can be assembled also as twin-cylinder engines. The conclusion arrived at is that this method is not satisfactory for high speed multiple-cylinder engines suitable for automotive purposes.

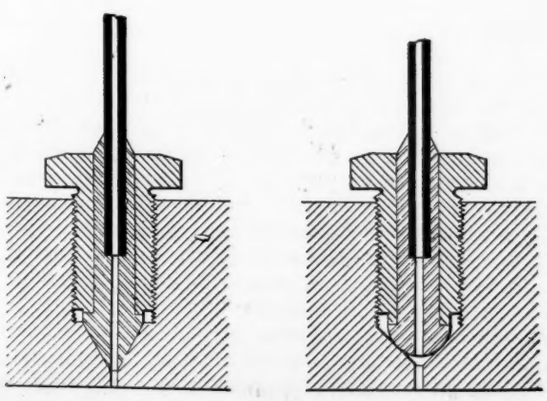


Fig. 3—A form of pipe connection used with great satisfaction in Diesel engine practice

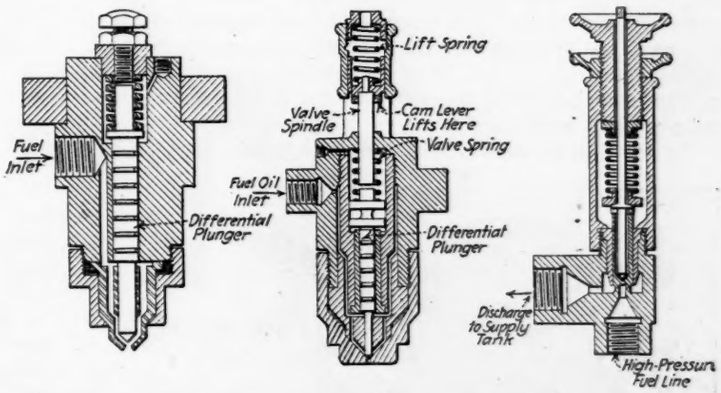


Fig. 4—Three types of injection valve. The valve at the left is controlled by the fuel-pressure difference and that in the middle has the fuel opening controlled mechanically by a cam and a lever. The valve at the right is pressure-regulating valve

The fuel is supplied to the injection valves of all the cylinders from a single main supply line which is maintained at constant pressure. The fuel injection valve shown in the center of Fig. 4 is mechanically operated by a cam and lever; the metering of the quantity of fuel for injection and the time and duration of the injection are under control of the governor acting on the fuel cam and lever. The fuel pumps are designed to pump two or three times the quantity of fuel necessary for full load conditions. The fuel pumps are made preferably from a forged steel block; the pump cylinders and valve seats being machined in the block. Packing glands for the pump plungers have been shown in Fig. 1 and the check valves in Fig. 2. Due to the high pressures that the pumps work against, the pump shaft and the eccentries must have liberal bearing areas and positive pressure lubrication. The use of several plungers of small cross-sectional area reduces the bearing loads. The pressure of the fuel is maintained constant by a pressure regulator holding suction bypass-valves open during a portion of the pump stroke, or by a spring loaded relief valve similar to the valve shown at the right in Fig. 4. The flat seat of the pressure regulating valve gives less trouble from chattering and wear than a mitered seat. The seat parts are made of hardened steel.

The constant pressure injection valve shown in the center of Fig. 4 consists of a differential plunger, spring loaded by a valve spring and also by a lift spring which forces a valve spindle onto the differential plunger. A cam operated lever lifts the valve spindle, relieving the lift spring and permitting the fuel pressure to lift the differential plunger against the valve spring. The movement of the differential plunger removes the injection valve from its seat and permits the fuel to be injected into the combustion chamber. The fuel cam action controls the (*a*) time of injection; (*b*) lift of the injection valve; (*c*) duration of injection; (*d*) quantity of fuel injected and (*e*) manner of injection. Variations in the time of injection can be accomplished by angular advancement or retardation of the fuel cam. The lift of the injection valve and the duration of the injection are determining factors in the quantity of fuel that will be injected. The injection valve lift, determined by the fuel cam lift, must be sufficient to permit free injection of the fuel without dribbling. The duration of injection depends upon the angular period of the fuel cam. As the fuel pressure is constant, the injection valve lift should remain practically constant during the period of injection. Varying the quantity of fuel for different load conditions should be accomplished by varying the duration of the injection period; in other words, varying the cut-off ratio, or the length of the constant pressure line. The rapidity with which the injection valve opens and closes is a determining factor in attaining the conditions of maximum pulverization. With the injection valve filled with fuel maintained at constant pressure and the fuel cam acting directly on the injection valve, the injection action can be much more rapid than with the variable fuel pressure generated by a cam and pump removed from the injection valve.

The constant pressure method is not subject to the adverse conditions which interfere with injection in the variable pressure method. The constant fuel pressure obviates trouble from the elasticity of the fuel and its containing system and also does not permit the entrapped air to expand and cause erratic injection. Any leakage that occurs in the fuel system with the variable pressure method is a wastage from the metered quantity of fuel that it is desired to inject. In the constant pressure method the metering is done within the injection valve so that leakage in the system does not affect the quantity to be injected.

In view of the considerations stated, the constant pressure method is preferable for small high speed engines in that the exact metered quantity of fuel is positively injected at the desired time, and in that uniform quantities are injected for uniform speed and load conditions. The experimental work has shown consistent progress but has not advanced to a point where further disclosure of methods and results is advisable.

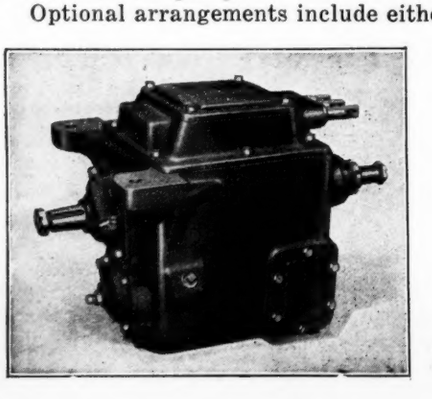
A New Model of Transmission

A NEW model of gearset known as Model 55 has been added to the line of the Brown-Lipe Gear Co. The new product was designed to fill a gap in its range of sizes and has several individual features.

Model 55 is of the main-frame type and in capacity is substantially midway between Models 50 and 60. Regular features are selective gears that give four speeds forward and one reverse; a rear mainshaft bearing cap that takes a speedometer drive, and two S. A. E. standard pads, one on the right and one on the left side of the case, intended respectively for a one-speed power take-off and a pump.

Optional arrangements include either overhead or side shift and—when a power take-off is not used—the mounting of the pump on the right side of the case. Of course, the option of shifts necessitates the selection of one of two forms of case, cover, etc., but the pump can be mounted on the right side at any time by adding to it a 2-in. filler block, furnished by the pump manufacturer.

The illustration given here shows the overhead shift. The side shift type transmission is less in depth by the height of the shifter housing, but slightly greater in width.



New Gearset Model

THE consumption of gasoline in Australia is increasing rapidly and is leading to an investigation of the possibilities of the Commonwealth. In 1910 the consumption was 25,725,000 gallons; in 1915, 43,000,000 gallons, and by 1919 it had increased to 51,000,000 gallons. Although the presence of oil is evidenced by its oozing from the ground in numerous places, drilling has failed to discover deposits of commercial value. The Commonwealth Government has offered a prize of £10,000 to stimulate further search, and the South Australian Government has also voted a bonus of £5,000 to the person or company that first obtains from a well in South Australia 100,000 gallons of crude petroleum containing not less than 90 per cent of products obtainable by distillation. So far the rewards have not been won.

Features of Mechanical Interrupters for Ignition Systems

Part II

In this installment the author describes the features of several commercial types of interrupters and discusses the advantages and disadvantages of these types. This completes the article and thus covers all the important considerations involved in the design of interrupters.

By Harry F. Geist

WE have magnetos made with stationary coils and magnetos made with rotating coils. In the cases where stationary coils are used the interrupter parts are also stationary and the interrupter is actuated by a rotating cam, but in the case of rotating coils, the interrupter parts are also in rotation and co-act with stationary cams for the actuation of the interrupter. In special cases where collector spools or buttons are used the stationary type of interrupter may be used with rotating coil type magnetos, but this construction is the exception rather than the rule. These two general differences in interrupter designs bring out entirely different considerations which are of interest.

In the rotating type of interrupter, all the moving parts are mounted upon the rotating breaker plate as shown by Fig. 1, so that the radius at which the bumper block of the lever arm actuates with the cam is fully twice as great as that of a rotating cam actuating a stationary type of interrupter.

With these two different arrangements, arguments for and against either type of interrupter may arise, but experience with both types has proven that both, in the highly perfected designs of the present day give very satisfactory service.

In order to show the different conditions that obtain in these two different types of interrupter mechanism, Fig. 8 is presented for an analysis.

The bumper of the rotating breaker arm is shown just at the point of striking the stationary cam, at the point O, from which point, instead of following the circular arc OB it follows the line of the cam contour OA, so that the angle through which the bumper is forced inward may be expressed roughly by BOA, giving the bumper an inward motion equal to AB or M.

If the distance from the arm pivot to the contact point is equal to the distance from the pivot to the bumper, then M will also be the amount of contact separation. At the higher speeds the bumper may receive a throw so that the motion it receives may be greater than the distance AB.

The force tending to hold the bumper against the cam contour or tending to hold the contacts closed will be the force of the spring F_s plus the centrifugal force of the lever arm F_c and plus or minus a force due to the inertia of the arm in its motion M that may be expressed by F_m. It is the usual practice in the design of rotating interrupters to so design the arm that the centrifugal force acting on the bumper end of the arm will be greater than the centrifugal force acting on the contact carrying end of the arm so that the rotation of the interrupter as a whole will give a resultant centrifugal force to the arm that will always tend to aid the spring. This is to assure that centrifugal force will never cause the contacts to separate, but on the other hand, will help to close them, and is a very important consideration in the development of rotating types of interrupters.

The force F_m is the most difficult to control. At the higher speeds it may become greater than F_s plus F_c and cause the bumper motion to exceed the amount AB. This force depends upon the mass of the lever arm swinging upon its pivot and upon the rate of bumper motion M. It is controlled to some extent by making the lever arm as light as possible without sacrificing mechanical strength. It is no doubt this force that is responsible for the vibrations of the contacts that was previously discussed.

In order to make a direct comparison, let us assume that it is desirable to have the contacts opening the same amount for the same amount of angular rotation of the magneto rotor in the case of the stationary interrupter and rotating cam. Under this condition, which is represented in Fig. 8, the rotating cam will force the bumper along its contour O′A′, so that the angle at which

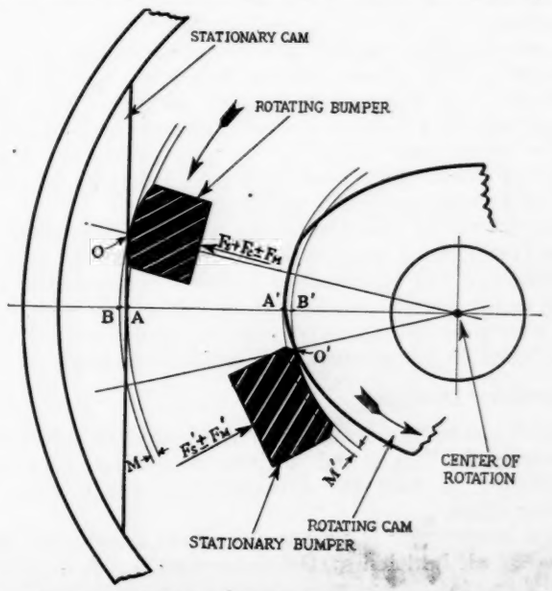


Fig. 8—Illustrating difference between rotating and stationary breakers.

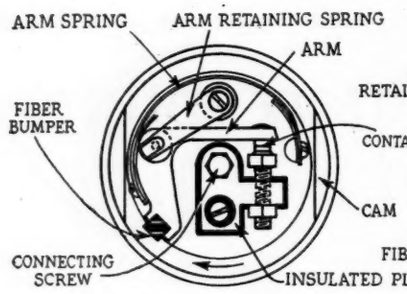


Fig. 9—A much used type of rotary interrupter.

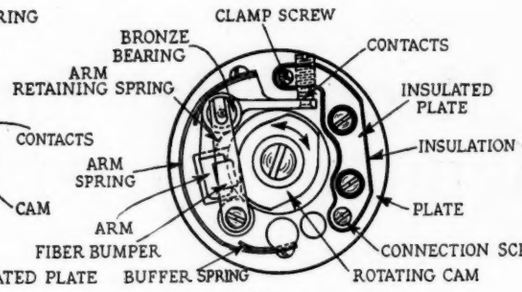


Fig. 10—A widely used type of stationary interrupter.

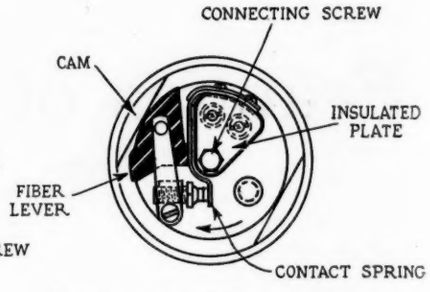


Fig. 11—A well known interrupter of novel design.

the bumper is forced with reference to the cam may be expressed by A′O′B′. This angle is roughly about twice as great as the angle AOB when the radius of action between the rotating cam and the stationary bumper is one-half the radius of co-action between the rotating bumper and the stationary cam, and provided A′B′ equals AB.

For the same rotor speed, therefore, the rotating bumper will travel at twice the peripheral speed of the rotating cam, but in moving inward on an average cam angle of only half as much it is evident that the speed at which the rotating bumper travels the distance M will be the same as the speed at which the stationary bumper makes the motion M′.

The stationary bumper is held inwardly by the forces F'_s plus or minus F'_m, where F'_s is the force of its spring and F'_m is the force represented in the inertia of the arm due to motion M′. Centrifugal force does not enter into play in this type of interrupter. In this stationary type of interrupter, just as was shown for the rotating type, the force F'_m may at higher speeds be sufficient to overcome F'_s and give the bumper a throw such that M′ will exceed O′A′ and may also be the cause of vibrations of the lever arm.

The advantage of the stationary interrupter lies in the fact that it is free from centrifugal force, since it does not rotate. It certainly facilitates the development of an interrupter not to have to take that force into consideration, but on the other hand this same centrifugal force serves to counteract the inertia that comes into play tending to give the arm excessive motion at higher speeds so that while it may complicate the development, it must be given credit as a valuable assisting force to the spring in holding down the contact motion and the vibrations that the lever arm is subject to.

In general interrupters are intended to open the contacts only from about .015 to .020 inch, and it would seem that for this small amount of interrupter lever action that the possibility of excessive contact separation and of vibrations would not be very great, but experience has shown that these results do take place at times even at average operating speeds.

The following interrupter designs are presented because they show a wide variation in the manner in which interrupters can be designed to meet the conditions set forth in the foregoing paragraphs. They are also excellent examples of exclusive features and distinctive design found in the present day ignition systems.

Interrupter Designs

Fig. 9 shows the features of the complete interrupter illustrated in Fig. 1 and the arm retaining spring that is adapted to hold the lever arm in place upon the breaker plate.

This interrupter is perhaps the best known and most copied of all ignition system interrupters. It is used by a number of different manufacturers both in the United States and abroad. The features that contribute to the success of this interrupter, which is of the rotating type, is the perfect balance of the arm for all speeds at which it is designed to give service. There is just enough mass in the fiber bumper end of the arm which is located farther from the center of rotation than the contact carrying end of the arm to assure just enough centrifugal force to make certain that the contacts will not open due to rotation alone and that the force of co-action of bumper and cam will not give the contacts an unnecessary or an undesirable amount of opening.

The main spring is backed up by two buffer springs, one at each end, that keep the springs from breaking, relieving as they do any tendency for a sharp bend that would produce early fatigue. The cams are oiled by wicks embedded in them. No other oiling is required, hence oil cannot get to the contacts. The centrifugal force due to rotation tends to keep all the oil away from the rotating parts of the interrupter.

For right- or left-hand magneto rotation entirely different interrupters are necessary.

Fig. 10 shows the most widely used stationary type of interrupter. The arm is a drop-forging carrying a platinum contact on one leg and a hard, polished bumper that is formed to have a radius to suit the cam at the other leg. The arm pivot bearing is of bronze and fits a hardened steel pivot, which in some cases is hollow, making it possible to oil the pivot bearing through a vent in the stationary breaker plate. The condenser and primary winding are connected to the interrupter by a common lead that is secured to the insulated plate by means of a screw. This insulated plate, of course, carries one of the contacts.

The cam is designed for either right- or left-hand rotation by merely turning it over on the shaft, and it has lobes to correspond to the number of sparks that the magneto is designed to deliver per revolution of the rotor. Other features are as shown. The breaker plate is set and locked by screws to the magneto bearing plate in timed relation to the magnetic break between rotor and stator of the magneto for "fixed" spark installations and to the rocking member of the magneto for variable spark ignition.

In Fig. 11 is illustrated another well-known interrupter mechanism of very novel design. This interrupter is of the rotating type. In this design the insulated contact is carried upon a spring that is secured at one end to an insulated plate. The adjustable contact is the grounded one. A triangular fibre lever that is pivoted at the center acts through one of its corners upon the cams, which force the contacts apart. The third corner is merely to balance the lever during its rotation.

In the discussion connected with Fig. 6 it was pointed out that a rocking break was very apt to be obtained in interrupters in which the contact was mounted directly upon the spring, due to a strengthening out of the spring between the points F and F_1 immediately following the application of the force F_1.

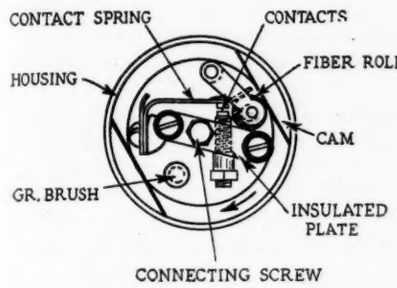


Fig. 12—A type of interrupter used in England.

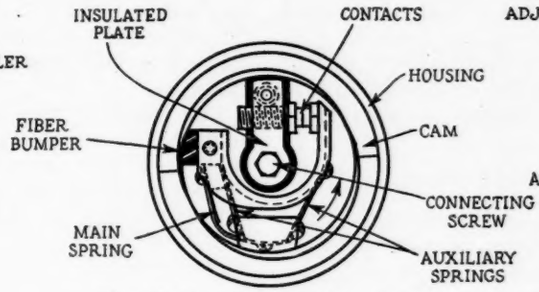


Fig. 13—A recent design of interrupter.

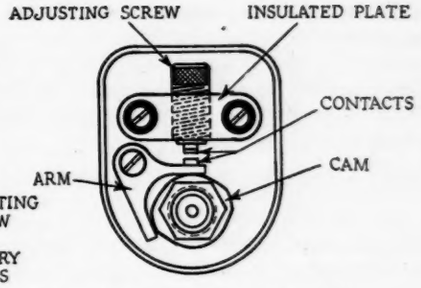


Fig. 14—A positively operated interrupter.

In this particular application of this general type of interrupter it will be noticed that the spring has a double bend between the contact point and the point at which the fibre lever acts. This stiffens the spring in the region of the bend. The tension of the spring in this case is, therefore, almost entirely on the other end of the spring; so that when the force tending to open the contacts is applied it is accomplished very effectively. The secret of the success of this particular application in avoiding the rocking of contacts is due to the bends in the spring at the places shown.

During rotation, the fibre lever is under the influence of centrifugal forces. These are intended to be balanced by the triangular shape of the lever, but the forces are allowed sufficient surplus to always keep the lever away from the spring except when in engagement with the cams.

Fig. 12 illustrates another novel design of rotating interrupter that is produced in England. In this mechanism the grounded contact is mounted directly upon the spring. The end of the spring projects considerably beyond the contact and is turned up at an angle, as shown. The insulated plate also sets at an angle to the spring, so that it and the bent end of the spring form a "V" in which a loosely bearinged roller is located. The action of the mechanism during rotation throws the

in contact with the cams, which, in turn, force the roller into the "V," tending to lift the spring and its contact away from the insulated contact to break the circuit.

The liability of a rocking break of the contacts and its coincident troubles, as pointed out in connection with Fig. 6, is alleviated by the fact that the roller, which is of fibre, acts upon the spring at a point that is very close to the contact. This close application of the roller force to the contact tends to open the contacts without rocking.

Centrifugal force in this interrupter always keeps the roller as far from the center of rotation as possible, and it, therefore, can exert no force upon the contact spring until compelled to do so by the cams.

The interrupter represented in Fig. 13 is a comparanew product. It is also of the rotating type and differs from the other arm types in that it has no pivot or bearing for its arm. A main spring serves to perform the same functions of the usual interrupter arm spring; namely, to hold the contacts normally engaged. In addition, there are two auxiliary sets of leaf springs which tend to guide and support the motion of the arm. The purpose of the arrangement is not only to do away with the pivot and bearing but to give the moving contact a parallel motion with respect to the insulated contact. The advantages of this parallel motion were pointed out under the discussion of Fig. 7.

The cam in this breaker mechanism is produced by grinding two eccentric circles at 180 degrees displacement from each other and at equal distances at either side of the center of rotor motion.

The interrupter illustrated in Fig. 14, which is of the stationary type, is also comparatively new and has some very interesting and novel features. The arm is free from springs and forms a "V," in which a cam rotates and performs both the functions of closing and breaking the circuit at the contacts.

In order to take up the mechanical shock of closing and to allow for variations in production and for adjustment, the insulated contact is mounted upon a sliding plunger that is backed by a compression spring in a knurled and threaded barrel. Adjustment is made by means of this threaded barrel.

The principal advantage gained by this construction beside the simplicity of its construction, is that the time of make of the circuit is definitely determined at all times by the relation of the angle of the arm "V" and the cam lobes.

Another very interesting type of interrupter mechanism is that illustrated in Fig. 15. This type is based upon the principles discussed under Fig. 7. In this particular design it is shown for use with rotating winding types of magnetos, but the principle back of it is applicable to the stationary type of interrupter as well. The principal merits of this interrupter are the parallel motion of the separating contacts and a very quick and definite break of the circuit for a very small throw of the arm, so that the wear and the forces due to inertia to which this interrupter is subject are reduced to a minimum. The arm is also of very light construction, having, as it does, only one projecting end from the pivot, so that the forces to which the contacts are subject in closing are reduced to practically only that of the tension of the spring. Any centrifugal force at play upon the arm aids the spring.

The tendency is in this type of interrupter action for the spring to close the contacts very quickly following the separating action, so that this type of interrupter lends itself very effectively to battery and coil types of

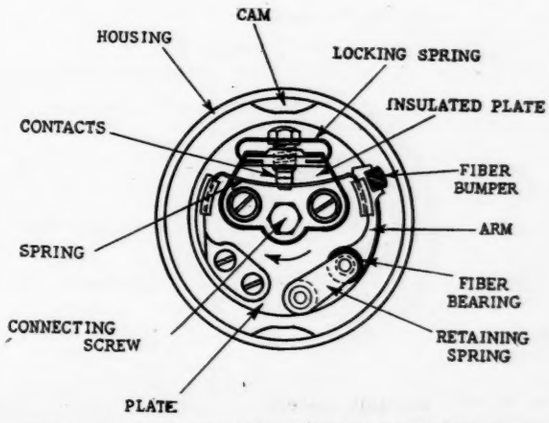


Fig. 15—A novel type of interrupter possessing many advantages.

ignition systems, because of the fact that the period necessary for the sparking action of the coils is very short and the interrupter allows a large percentage of the complete cycle of the action to be on closed circuit. This is a decided advantage in battery systems operating at high speeds.

Interrupter with Tungsten and Silver Contacts

During the war with Germany platinum supplies were limited, and ignition manufacturers did considerable experimentation with contacts made of other material. Tungsten had been used for a number of years and had given satisfactory results under special conditions. Its principal objection was that of oxidization. It has been found in rotary magneto work that tungsten will function properly as long as the magneto is in continuous operation, but if the magneto stands over night with its contacts separated the oxidization may be sufficient at times to make starting very difficult. In special cases, such as in so-called oscillating magnetos, in which the normal rest position is always one in which the contacts are closed, this trouble is very much reduced, so that with tungsten comparatively cheap it made a very good substitute.

To solve this problem, in the case of rotary magnetos, a very novel interrupter was invented and developed by C. T. Mason for the Splitdorf Electrical Company. This interrupter consisted of two sets of contacts, one set acting for starting service and the second set operating for running service. The starting contacts were of silver and the running contacts were tungsten.

Fig. 16 illustrates the essential features of the design as used with magnetos having stationary coils.

The principal difference of this type of interrupter from other types is as follows: The silver contact on the grounded side is rigidly connected to the lever arm in the usual manner and it makes contact with another silver contact that is adjustably mounted in an insulated plate, to which the primary lead makes connection as in the usual construction. In addition, the lever arm carries a spring that extends parallel over the top side of the arm and terminates over a hole in the lever arm. A tungsten contact mounted upon this spring extends through the hole in the arm and engages with another tungsten contact that is also adjustably mounted in the same insulated plate with the silver contact. The tension of the tungsten contact carrying spring is such that it exerts a pressure downward. The adjustment of the interrupter contacts must be such that the silver contacts separate before the tungsten contacts do.

When the cam strikes the fibre bumper of the lever arm it first lifts the arm and therefore breaks the contact between the silver contacts. The break between the tungsten contacts occurs a very short time afterward—as soon as the bend of the contact carrying spring is taken up.

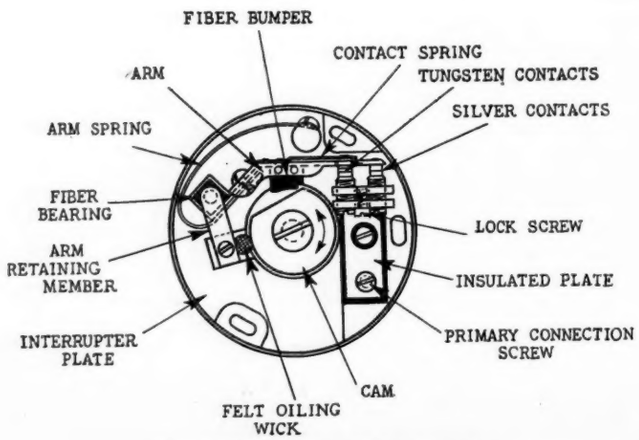


Fig. 16—Mason two point interrupter.

The result of this sequence of contact separations is such that if the tungsten contacts should be oxidized to such an extent at starting that the high resistance of the oxide makes the magneto inoperative, the completed circuit through the silver contacts which do not oxidize readily will allow the magneto to function and the spark will be produced when the silver contacts separate. The engine will therefore start up on the action of the silver contacts.

After a few revolutions of the engine the mechanical action between the tungsten contacts of the interrupter cleans them, and because of the fact that the tungsten contacts separate last, the final interruption of the circuit transfers to the tungsten contacts as soon as they begin to conduct current. It therefore follows that the tungsten contacts operate for running service.

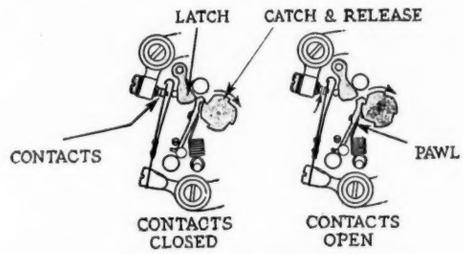


Fig. 17—The Atwater Kent Interrupter.

All the arcing and welding action of service is taken up by the tungsten contacts, and the silver contacts are thus protected during the running service, and they do not function electrically again until the tungsten contacts again become inoperative, except to carry a part of the primary generated current. The action of this interrupter is entirely automatic.

The only objection to this type of interrupter lies in the fact that the trade has not been educated to the adjustment of this device, and it would no doubt be considerable of a task for a layman to make the adjustments of this mechanism properly and intelligently.

The supply of platinum to ignition manufacturers was never completely cut off, hence it never became necessary to change to the double contact type. It does illustrate, however, how the tungsten contacts can be pressed into service in spite of its tendency to oxidize.

Battery and Coil System Interrupters

From the very earliest days of battery and coil ignition systems it was recognized that for ordinary make-and-break circuit interrupters the average user would very often forget to switch off the ignition circuit after stopping the engine and allow the ignition system to drain the battery during idleness of the engine if the contacts chanced to be closed.

It was also recognized that for the slower speeds of engine operation the ordinary make-and-break igniter interrupter would take a great deal more battery energy than was necessary for effective operation of the system compared with that required for running speeds.

To overcome these two drawbacks a special battery and coil ignition system interrupter was developed and marketed by the Atwater Kent Mfg. Co. This interrupter is illustrated in Fig. 17.

The illustration shows a catch and release device which, during its rotation, catches a pawl and advances it against the tension of a coil spring to a position above

a latch. After reaching this position the pawl is automatically released and is then drawn back toward its normal rest position due to the tension of the coil spring. In returning to this rest position the heel of the catch and release tooth so guides the pawl that it is compelled to strike against the latch. The motion imparted to the latch by the pawl in turn causes the contacts to close momentarily and separate again after the pawl passes the latch. This make-and-break action takes place at a very high speed, and at a speed that is independent of the speed of rotation of the catch and release member. This special type of battery and coil circuit interrupter

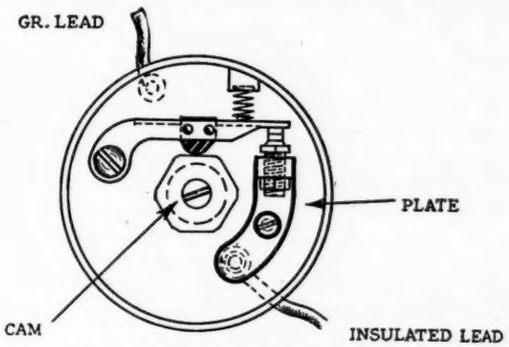


Fig. 18—Typical battery and Coil system interrupter.

therefore assures that the spark will be of the same value for all engine speeds within the limits that the device is designed for and that the battery energy required per spark will also be practically constant for all speeds.

It must also be evident that when the engine is at rest the pawl will be at rest and so cannot close the circuit, and it can never remain in a position that will keep the contacts together.

The particular mechanism shown in Fig. 17 has a catch and release with four teeth and so is designed for four-cylinder engines, being operated at half engine speed in this case. The figure shows both open and closed positions of the contacts.

Fig. 18 shows a simple battery and coil system interrupter that is representative of the more usual types. It has a six-lobe cam and is designed for a six-cylinder engine, but can be converted to a four-cylinder system by using a cam with four lobes. It is evident that in this type of mechanism it is possible for the engine to stop at such a position that the contacts will remain closed, so that this interrupter requires a switch for cutting off the battery when the system is not in use. It is also evident that the period of time allowed for the closing of the contacts depends upon the speed at which the cam rotates, so that at slower speeds more energy will be delivered to the coil for spark production than will be the case at higher speeds.

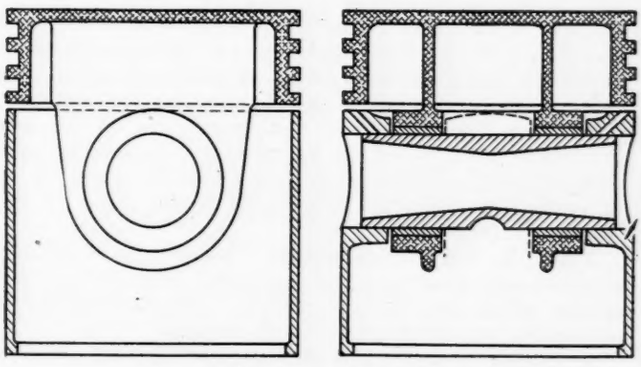
This difference in amount of battery energy consumption for different operating speeds used to be a very important consideration in the days of dry cells, but in the present time the use of storage batteries and recharging generators as part of the equipment makes this difference of battery economy of little importance. Furthermore, since the advent of high-class lock switches the user has become accustomed to switching off the battery, so that the general type of battery and coil system interrupter shown in Fig. 18 serves its purpose very well.

In the foregoing paragraphs the writer has endeavored to cover all the important interrupter considerations that have come to his observation, and, while all the different designs of interrupters now in use have not been shown, the few selected as illustrations are presented because of some very distinctive features employed to meet the conditions under which an interrupter must function.

A New Cross-Head Piston

A CROSS-HEAD type of piston designed to take advantage of the properties of both aluminum and cast iron has recently been made the subject of a patent application. The combined aluminum and iron piston is not new to the trade, but the design shown herewith includes also the cross-head characteristics, the upper part of the piston floating on the wrist pin. The piston can be fitted or adapted to the ordinary cast iron piston by cutting this off above the wrist pin and applying the aluminum upper portion. The aim in pistons of this type is to use aluminum, which has the quality of high conductivity, for the parts exposed to heat. The cast iron skirt acts as a seal and guide, and because of its lower expansion under heat, can be fitted more closely than aluminum. In this case the skirt, being insulated from heat transfer from the head, remains comparatively cool and consequently does not expand appreciably. There is a gap between the aluminum and iron portion, so that differences in expansion between the aluminum and iron make no difference in the fit or shape of the piston. This also permits of oil drainage. The bronze bushing for the wrist pin is carried in the aluminum portion of the piston, thus transmitting the explosion forces directly to the wrist pin.

This piston, which is the design of O. E. Barthel, weighs approximately the same as a light-weight, semi-steel piston.



Barthel Cross-head piston.

ONE thousand and forty-one motor cars were imported into British India during September, 1920, and of them, 723 were consigned from the United States, and 287 from the United Kingdom. During the six months, April to September, 1920, the number of motor cars imported was 7,498, as against 2,553 in the corresponding period of the previous year. The United States recorded 5,654; the United Kingdom, 1,902; Canada, 542; France, 49, and Italy, 43. Bombay imported 2,775 cars; Bengal, 2,694; Madras, 908; Sind, 590, and Burma, 531.

Lumber Used in Motor Vehicle Manufacture

Here is an interesting and informative study of the lumber consumption based on 1920 production figures. The U. S. Forest Products Laboratory prepared the statement as the result of studies made by its engineers.

By Arthur Koehler*

THE rapid increase in the proportion of closed cars manufactured is an outstanding feature of the automobile industry. An official of a large company recently expressed his belief that in five years one-half of their output would be closed cars. Already one out of every eight passenger cars of a well-known make is a sedan or coupe. This means a large consumption of lumber, as the closed car takes from two to three times as much lumber as an open car, and a better grade of lumber is required to insure rigidity and freedom from warping in the closed body.

An engineer of the United States Forest Products Laboratory, Madison, Wis., recently visited a number of manufacturing plants to determine what woods are being used in the automobile industry, to what extent substitution of one species for another is taking place and what troubles manufacturers are having with wood.

The question of what kind of lumber to use in auto bodies is becoming a perplexing one. Ash has always been considered the most desirable wood for most of the parts above the running gear. It combines the properties of moderate weight, easy workability, high degree of toughness and comparative freedom from twisting. With keen competition in the trade and the high price of ash it is gradually being replaced by other kinds of woods in order to reduce the cost of production.

No data are available showing how much lumber of each kind is used in the automobile industry. From a visit to a number of automobile and body factories the writer is inclined to believe that maple leads in the construction of passenger car bodies and elm is next and ash third. Besides these species many others are used or are being tried out. The following brief description of the more important woods used in automobile construction gives some of their relative advantages and disadvantages, and in Table 1 is given the strength of these woods as compared with forest grown ash.

Ash: The cut of ash lumber consists almost entirely of white ash, green ash and black ash. The green ash is sold as white ash and is practically identical with it in properties, but black ash is not so strong.

A number of years ago commercial white ash was the principal wood used for passenger cars, but its great demand for this purpose, airplanes, etc., brought the price up so high that substitutes are used except in some of the high priced cars which still use ash for the sills, or throughout the whole body. Because of the higher quality of closed bodies, and the necessity of avoiding warping of the parts as much as possible, ash is used by some manufacturers for closed bodies but elm for open bodies.

In Table 1 the strength of second growth white ash and of black ash are given in per cent of forest grown white ash.

*Assistant in charge, Section of Timber Physics, Forest Products Laboratory.

On account of the greater difficulty of machining maple than ash, some prefer the ash from an efficiency standpoint even though it costs a little more originally.

Much of the white ash growing in the northern states has been cut out, and over half of the supply now comes from the states bordering on the lower Mississippi River. Unfortunately, ash like other hardwoods growing in the southern swamps, produces a certain amount of light wood which is apt to be brash, especially in the swelled butts of the trees. This necessitates sorting out the material and eliminating all light pieces for purposes where strength is important.

Maple: Very little soft maple is used, nearly all of the wood which goes into bodies being hard maple. It is extensively used for sills of passenger cars. In some cars it is also used for the framework of the body and even for the floor and running boards and battery boxes.

Maple is fully as strong and stiff as a beam or post as white ash, but not as shock resisting, as is indicated in Table 1. It usually is cheaper than ash and runs more uniform in strength. Maple warps very little, in this respect being superior to elm. On the other hand, maple is more difficult to season without checking than ash or elm, and it is said not to hold screws so well in use in automobile bodies.

On account of the smooth fine texture of maple, paint and enamel will rub off more easily, especially on curved surfaces which receive considerable wear, than on birch which is slightly more porous.

Because of its smooth wearing qualities and comparative freedom from slivers maple is preferred to all other woods for the floors of delivery wagons.

TABLE 1.—STRENGTH OF WOODS USED IN AUTOMOBILE CONSTRUCTION IN PER CENT OF THE STRENGTH OF FOREST GROWN WHITE ASH*

Species	Strength as a Beam or Post	Stiffness	Shock Resisting Ability	Hardness
Hardwoods:				
Ash, white, forest grown	100.0	100.0	100.0	100.0
Ash, black	71.3	79.3	90.1	62.3
Ash, white, second growth	122.5	117.6	119.6	118.9
Basswood	59.1	80.6	40.5	29.6
Beech	93.5	96.9	96.0	90.0
Birch, yellow	104.8	116.8	120.6	80.9
Chestnut	66.0	71.9	53.4	49.2
Cottonwood	60.6	79.0	54.3	35.3
Cucumber	85.4	112.4	76.7	54.9
Elm, rock or cork	98.8	92.9	140.5	101.6
Elm, white	79.2	79.5	89.5	57.1
Gum, red	80.7	91.5	75.5	59.0
Gum, tupelo or cotton	81.4	82.5	63.5	77.3
Hickories, pecan	103.5	103.8	119.7	139.6
Hickories, true	126.6	120.2	173.9	150.4
Maple, red	90.0	101.2	78.7	75.4
Maple, silver	66.9	68.5	71.7	64.3
Maple, sugar	104.7	105.9	90.5	103.0
Oaks, all kinds	92.6	101.3	94.9	104.5
Poplar, yellow	67.3	93.8	41.5	37.9
Conifers:				
Firs, Douglas, Pacific Coast type	95.7	122.1	59.9	58.3
Pine, loblolly	93.7	105.6	71.0	60.0
Pine, longleaf	112.2	122.1	77.7	74.8
Pine, shortleaf	94.1	100.6	69.7	64.0
Pine, western, white	75.5	99.7	53.8	37.0
Pine, western, yellow	67.0	75.6	42.9	41.0
Spruce, Sitka	69.5	94.1	63.3	44.9

*For information on actual strength values of these and other species see United States Department of Agriculture Bulletin No. 556, "Mechanical Properties of Woods Grown in the United States."

Elm: Soft or white elm is the principal species of elm used in automobile manufacture. A little rock elm is used for some of the bent parts, but otherwise white elm is preferred because it is more easily worked and is less subject to warping. Lumber from old white elm trees, usually called "grey elm," is preferred to that from younger, or vigorously growing trees, because it is more easily worked and gives less trouble in seasoning and manufacture because it warps less.

The principal use of elm is for frames, seat backs and doors; very little, if any, is used for sills. Old white elm is not so strong or tough as ash on the average, but it varies less in strength than ash, especially that which comes from the southern swamps.

Birch: Yellow birch is used considerably in automobile manufacture and is a close rival of maple. It is used for sills, framework and other minor parts. It is preferred to maple on exposed painted parts because it is said to hold the paint better. Its use probably is increasing.

Hickory: The use of hickory in automobile manufacture is confined almost exclusively to the spokes and felloes. In recent years the wooden felloe in automobile wheels has been replaced to a large extent by a steel rim into which the ends of the spokes fit. If this substitution proves satisfactory it will be of decided economic significance, since it will leave a large amount of hickory for the manufacture of handles for which there is no satisfactory substitute. The present trend toward the all metal wheel already eliminates thousands of hickory spokes, but it is too early to say how far this substitution may be expected to go. There is a certain resiliency in the hickory spoke which is not easily duplicated with other materials.

No distinction is made between the true hickories, such as shagbark, big shell bark, mockernut, and pignut, but the pecan hickories, such as pecan, bitternut, nutmeg and water hickory are, as a class, inferior in strength to the true hickories, especially in shock resisting ability. The pecan hickories might be used in place of ash, elm, birch or maple in the body, although their hardness and tendency to twist might prove a serious drawback to such uses.

Red Gum: This species name includes both the sapwood and heartwood. It is used for floor boards, seat risers, seat boards and other minor parts, but it is too weak and soft for the sills or other major parts of the frame. One of the principal drawbacks to the use of gum is its tendency to warp when used in places where it is subject to changes in moisture content. Quarter sawed gum boards give less trouble in warping than plain sawed boards.

Oak: In automobile construction no distinction is made, as a rule, between the different species of oak or even between the red oak and white oak groups. In passenger cars oak is rarely used for the frame or sills. Wormy oak is used for running boards, floor boards and seats. Some sound oak is used for instrument boards and battery boxes.

Top bows are made almost exclusively of oak, second growth being preferred.

In trucks, on the other hand, oak is one of the leading woods. It is used for sills, cross sills, frame of body, floor and stakes.

In Table 1 all the oaks in which tests have been made are grouped together under one name.

Southern Yellow Pine: Under this heading are included longleaf, loblolly, shortleaf, and some of the minor southern pines. The use of yellow pine in automobile manufacture probably is increasing. It is used for running boards, floor boards, seat boards and a number of small parts in the seats and frames.

Other Species Used: The above descriptions cover the principal woods used in passenger and freight automobiles. Numerous other species are used to a limited extent. Cottonwood is used for dash boards of passenger cars and the boxes or bodies of trucks. Sycamore, beech, basswood, yellow poplar, cucumber, tupelo, gum, chestnut, Douglas fir, western yellow pine and possibly other woods have been used in small quantities.

In addition to these, fancy woods, such as walnut, cherry, mahogany, rosewood, tulip wood, etc., are used for trim in high priced cars.

Table 2 shows the kinds of wood used in the different parts of an automobile, based on a study of those companies which made bodies for a number of automobile manufacturers.

Table 2—Kinds of Wood Used in Open Cars

Sills, longitudinal and cross	Ash, hard maple, and occasionally elm, red gum, magnolia and soft maple.
Floor boards	Sound and wormy oak, hard and soft maple, red gum, beech, wormy chestnut, elm.
Seat risers, or "heel boards"	Hard and soft maple, red gum, yellow pine.
Seat boards, or seat frame	Hard and soft maple, red gum and numerous other species.
Seat lids	Maple, gum, elm and numerous other species of plywood.
Pillars and posts	Hard and soft maple, ash, elm, sycamore and red gum.
Seat rails (arm and back)	Ash, elm and maple.
Strainer slats, or "spring slats"	Maple, ash and gum.
Doors	Hard and soft maple, ash and elm.
Trim rails	Rock elm.
Running boards	Wormy oak, yellow pine, maple, Douglas fir.
Steering wheels	Walnut, maple, red gum.
Spokes	Hickory.
Rims ("felloes")	Hickory.
Top bows	Oak.
Dash	Cottonwood and maple.

It is estimated by the Forest Products Laboratory that the total amount of wood used in the construction of automobiles and motor trucks in the United States amounted to 384,751,000 ft. b.m. in the year 1919. The total consumption of wood used in the industry is roughly estimated in the accompanying Table 3.

Table 3—Amount of Lumber Used Annually in the Manufacture and Shipment of Passenger Cars and Motor Trucks, Based on 1919 Production of Cars

Total output of passenger cars	1,883,158	
Average number of board feet of lumber used per car	160	
Total lumber used in passenger cars		301,305,280 bd. ft.
Total output of motor trucks	322,039	
Average number of board feet of lumber used per truck, including body	200	
Total lumber used in motor trucks		64,407,800 bd. ft.
Total number of passenger cars exported	141,477	
Average number of board feet of lumber used in export crating of passenger cars	660	
Total lumber used in export crating of passenger cars		93,374,870 bd. ft.

Total number of trucks exported	29,288	
Average number of board feet of lumber used in export crating of trucks	760	
Total lumber used in export crating of motor trucks		22,458,880 bd. ft.
Grand total		481,546,780 bd. ft.

Computation on basis of 1920 figures made by AUTOMOTIVE INDUSTRIES.

The amount of lumber used in each car varies from 75 ft. b.m. for a small open car to 200 ft. b.m. for a medium-priced touring car. An average given by a large body manufacturing corporation is 140 to 150 ft. b.m. for open cars for each body. A small sedan requires 225 ft. b.m. and a large sedan, not including running boards, uses about 310 ft. b.m. One company stated that the average waste was about 30 per cent, including drying losses, cutting and minimum jointer waste, although others place the waste as high as 40 per cent.

In automobile work, firsts and seconds are used nearly exclusively. One company used 75 per cent first and seconds and 25 per cent No. 1 common. A large body company used 40 to 50 per cent first and seconds, and the rest No. 1 common of maple, elm, and oak. Another company making high-priced cars will take only 20 per cent of No. 1 common.

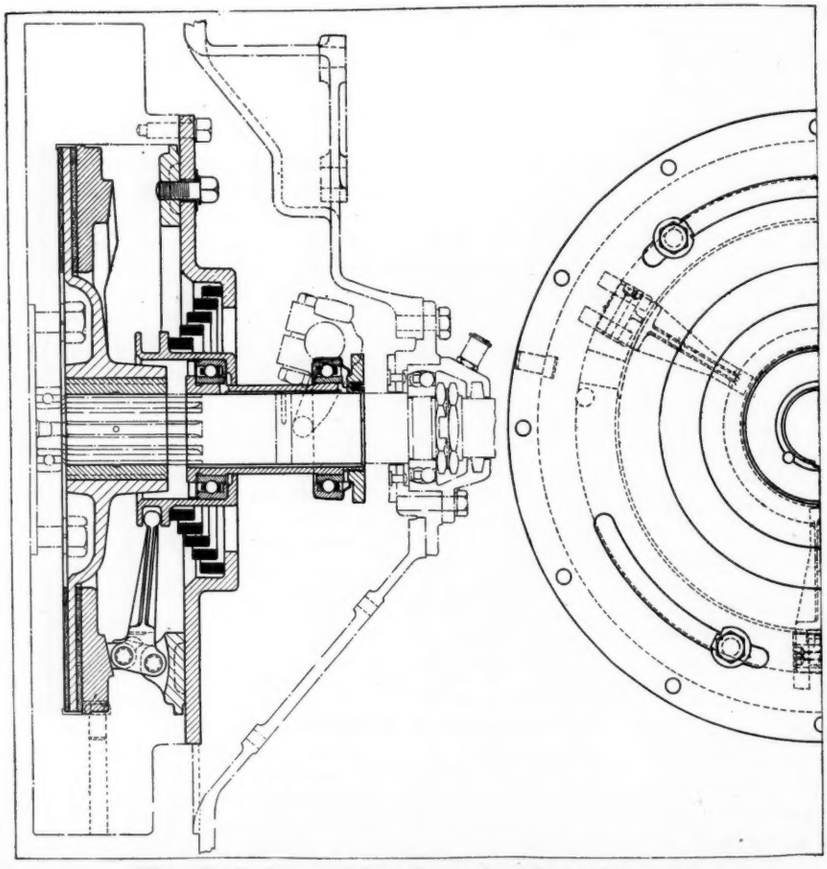
A Heavy Duty Single Plate Clutch

A NEW 14-in. heavy-duty clutch has been placed on the market to meet a demand for a single plate clutch which will satisfactorily transmit a torque of as high as 350 lb.-feet. This clutch is intended especially for tractor and heavy-truck service. The area of the friction surface is 100 sq. in. and the unit pressure on this surface approximates 30 lb. per sq. in. The friction mats are of a type recently developed for the Borg & Beck clutch and are said to have shown satisfactory results even with a unit pressure of 60 lb.

The drive is transmitted from the friction disk to the shaft through a 1¾-in. diameter 10 spline S. A. E. standard fitting, the length of this fitting being 2½ in. Lubrication of the splines is provided for by turning a groove centrally in the bore of the friction disk, slightly larger in diameter than the top diameter of the splines. This groove communicates, by means of radial holes in the shaft, with an axial hole extending the entire length of the shaft, so that when this hole is fed grease either from a compression cup or grease gun, the pilot bearing, splines and thrust bearings are simultaneously lubricated.

The thrust bearings are alloy steel, heat treated and ground to close tolerances. These bearings are claimed to possess advantages in respect to efficient lubrication, quiet operation and ability to withstand constant use.

Three adjustment screws pass through the cover of the clutch, and each screw has only one repeat hole, spaced equi-distant from the bell crank, so that the mounting ring is always held rigidly to the cover, thus eliminating any tendency of the ring to spring and cause drag when the clutch is released. This clutch is known as type F.J.X. and is manufactured by the Borg & Beck Co.



Model F.J.X. Borg and Beck heavy duty single plate clutch.

Chemistry of the Earth's Crust

ASSUMING the earth's crust to be a layer about 10 miles deep, Henry S. Washington of the Geophysical Laboratory, writing in the Journal of the Franklin Institute, estimates that 95 per cent of the crust is made up of igneous rocks, mainly silicates of Al, Fe, Mg, Ca, Na, K. Silica itself represents nearly 60 per cent of his mass of the crust. His percentages are in round numbers: Oxygen, 46; silicon, 28; aluminum, 8; iron, 5; calcium, 3.6; sodium, 2.8; potassium, 2.6; magnesium, 2.1. All the other elements are calculated to be present in less than 1 per cent each: titanium and phosphorus, each, 0.13; hydrogen, 0.127; manganese, 0.01, etc., and in order fluorine, chlorine, sulphur, etc., with bromine, tellurium and platinum at the end of the series. The first-mentioned elements down to manganese are supposed to make up 99.6 per cent of the crust, while the interior of the earth would, it is concluded, consist largely of magnetic nickel-iron. These estimates are based upon varied considerations and upon the analyses of some 5000 rocks.

Factory Service Relations with Dealers

The part played by the engineering department in regard to defective parts was one topic discussed at a recent convention of factory service managers. The dealer is now in the position of a buyer in a buyers' market and seems to be getting more consideration than heretofore. Parts prices and return of parts to factory for credit discussed.

By J. Howard Pile*

THE outstanding feature of the convention of Factory Service Managers, held under the auspices of the National Automobile Chamber of Commerce at the Hotel Iroquois, May 16, 17 and 18, was the changed attitude of the factory toward the dealer and distributor. In past conventions of this kind there has been a dictatorial attitude, and the theme of the papers and discussions has been what the factory shall "allow" the dealer. With the factories now seeking to sell more cars, and the dealer in the advantageous position of a buyer in a buyers' market, these things have changed and many agreements and practices to the advantage of the dealer are approved which six months ago would have been turned down flat.

The attitude of some of the factory managers toward parts prices was somewhat disappointing. While owners have been looking for more satisfactory prices on service work, and dealers and distributors have, in many cases, devoted much thought and time to the development of service stations that could render more economical service, the attitude of some of the factories seems to be to put as much on parts prices as the traffic will stand. While the prices of the parts may not seem so high according to lists, there are transportation charges, handling charges and taxes which have to be undertaken by the purchaser, and several suggestions that parts price lists to the car owner be discontinued, so that he would not know how much he was going to have to pay, seemed to meet with approval, although some objected.

The relation of the engineering and service departments of the factory was discussed at some length, following papers by Bachman of Autocar and Rippingill of Hudson. The point of contact between these two departments is in the return of defective parts to the factory. In some factories the practice is for the engineering department to pass on credit for these parts, the idea being that the engineering department thereby will see what parts are falling down and will be able to redesign where necessary. As a matter of fact, it would seem that ordinary defective parts can be just as well decided on either by the factory service department or the local service department with quicker action, which would result in benefit to the owner. Reports could be made out on these ordinary defective parts and turned over to the engineering department. Any extraordinary defective part could, of course, be returned to the engineering department for personal inspection. Very few factories require all parts to be returned to the factory before credit will be granted, but most every factory requires that certain classes of defectives be returned. It was suggested at one point that all service departments should be self-supporting, and this view was very vigorously attacked by Chairman Cummer of Autocar, who stated that he felt that the service department was not a profit-making department and was in the same class with advertising, auditing, etc., which departments, while they produce good and assist in the sales of the cars, cannot be expected to pay their own expenses or even a portion. This frank statement was very generally approved of.

There seems to be a tendency on the part of dealers at the present time to return parts to the factory for credit. This situation has been brought about by unwise orders placed during times when stocks were scarce at the factory, and dealers are now seeking in many cases to reduce their inventory. The remedy for this would seem to be to place a charge of 10 per cent on all material returned for credit, with the exception of parts made obsolete by new designs. Current parts should be checked up pretty carefully to prevent dealers from cutting their stocks down below the minimum required amount. The deterioration of equipment on cars which have been in stock for from five to six months was brought up for discussion, and H. Barcroft White, a dealer in Syracuse, suggested that manufacturers get together and handle this situation along safe and sane lines. A discussion of topics covering transportation charges on parts to dealers at distant points brought up the advisability of furnishing the owner with a printed price list of parts. Inasmuch as some factories allow the dealer to charge the owner transportation charges and sometimes handling charges, it was felt that the owner would have a legitimate kick if he found the prices actually charged, including all these items, was very greatly in excess of the printed list gotten out by the factory. It developed that a good many factories did not furnish such lists to car owners.

*Technical Editor, *Motor World*.

Who's Got the Button?

Editor AUTOMOTIVE INDUSTRIES:

I would like to have the addresses of the company building the highest type of four-cylinder, high efficiency motors. This company is planning a new type of high efficiency four-cylinder motor car and wishes to obtain the very best engine that it is possible to obtain. Only the superlative product will meet the requirements.

FINN S. HUDSON, U. S. Products Corp.

An Experience in Foreign Automobile Advertising

One of the very interesting points about this paper is that it applies so directly to domestic advertising. The big factor appears to be to decide on an objective, then on a method, sticking as closely as possible to both.

By Frederick Dickinson*

THE company which I represent entered the field of foreign advertising, as a great many companies in the early days entered it, at the point of least resistance. Within two years of our establishment we had secured a good, strong foothold abroad, largely through the efficacy of a rather daring and remarkable piece of "stunt" publicity. Within a very short time after that we had established ourselves rather firmly, because of the timeliness of our entry and the peculiar adaptability of our product to the foreign demand.

Advertising, in a formal sense, played a very small part at the beginning of our export merchandising. It is amusing to look back at those early days and note that out of the mass of formal advertising which grew out of our entry into the foreign field, the bulk of it was used in this country to establish ourselves in the domestic field. It apparently never occurred to us that information concerning our remarkable world tour could be disseminated through the export publicity media in such a way as to develop our export market. We used this information right at home, and profited by it greatly. But that, speaking generally, was as far as it went. The reason for this was our complete ignorance, even after a couple of years of export merchandising, of the ways and means by which export advertising, in a formal sense, is accomplished.

That ignorance, by the way, exists to-day in the minds of many organizations selling in the foreign field, and I am frank to say that after all of these years, and after considerable study and marked improvement, our organization has not entirely solved the export advertising problem. Hence the necessity and the desirability of such discussions as these in which we are now taking part.

But to go back: Circumstances were considerably kinder to us than we were to ourselves. In spite of our almost criminal ignorance of how it could be developed by advertising, our foreign demand increased. The impetus given it by our dramatic entry had not died out, and it was further stimulated by what was practically a repetition of the original stunt.

Again, I must confess that that repetition was undertaken largely to furnish material for domestic use. It seems unbelievable, doesn't it, that intelligent men could be so blind as not to realize the possibilities of what they were doing for use in one field, and so keenly conscious of its use in another field? But, again, I must give as an excuse the seemingly impenetrable darkness which surrounded formal foreign advertising.

Speaking from the standpoint of an advertising man, we did not deserve the success we secured; but nevertheless success was ours. Our distributors dotted the globe, and they were selling all of our product that we could, or thought we could, afford to give them.

Then, one by one, these distributors, in a very limited and groping way, began to advertise. In those days they advertised, I sincerely believe, not because they needed it, and not because they had a complete realization of what advertising could do for them, but because it seemed the natural and expected procedure for a man in business to spend a certain sum, very indefinite in amount, and very haphazard as to method, in advertising. A great many people, at home and abroad, are still advertising in this manner. They literally know not what they do, or why they do it. It is part of the game, just as the chiropodists, twenty years ago, all wore high hats, and the undertakers to-day all wear frock coats.

But as the years went by, this natural and necessary burden of advertising increased. The publications which profited by it kept pushing our distributors farther and farther along, and tempting them to more expensive efforts. Competition entered, and increased. Our distributors, with a vague conception of the possible good that might come from advertising, increased their own advertising burden to the point where they began to look around for some one to help them carry it. They naturally looked in our direction.

This marked the beginning, with our company, of the division of expense between the factory and the distributor on advertising bills, on the basis of a certain definite amount per car shipped, as the factory share. The distributor wrote his own advertising copy, selected his own advertising media, and determined the size and extent of his schedule.

Having entered upon this arrangement, it was continued for a number of years, and it is entirely to the purpose of my address to-day to tell you that on the whole it was a very unsatisfactory arrangement, and to tell you why.

I am not saying that it could not have been made satisfactory or that all similar arrangements have proved, and are still proving, unsatisfactory to other organizations. If I am to preserve the integrity of my remarks in a way that will make them, in the slightest degree, helpful to you, I cannot go beyond our own experience.

As to copy and the things that were printed in public regarding our product, we were at the mercy of about eighty separate individuals; practically all of them untrained as writers of advertising, many of them unacquainted with our product except in a most limited sense, most of them, because of distance and widely varying environments, unable to grasp our ideas and ideals. This condition made not only for inefficacious and useless copy, but for actually dangerous copy. Statements were made,

*Advertising Manager Hupp Motor Car Co. Paper presented at the Eighth Annual Foreign Trade Convention.

if not literally over our name, virtually with our sanction, that we could not substantiate. Misstatements were many, exaggerations the rule. In those countries where the precept "Let the buyer beware" still held sway, representations were made that got us into trouble. I recall one instance in particular where our product was advertised as "guaranteed for life." The ambiguous nature of that guarantee, interpreted according to our ideals, cost us money.

The question might be asked at this point: "Why didn't you furnish your own copy, thus helping the dealer out, and preventing unpleasant complications?" We did that very thing, but our distributors still had their own ideas. It wasn't strong enough for them. Some of them *wanted* to exaggerate and distort. It did not contain that evanescent "something," the absence of which even a child can detect, but the presence of which no one seems to recognize—local color. Many of them were willing to use our copy but no two of them wanted the same kind of copy. We were placed in the position of writing special stuff for every important country in the world, and submitting it to a captious critic in every one of them.

"Why, then, did you not force the issue, and refuse to participate in the expense of advertising of which you did not approve?" We did that, too; and became involved in endless disputes. We were pitted against four score "fathers," each fighting for his advertising child; and, what was more important, fighting for hard cash in the shape of an advertising allowance. Now, an endless dispute, carried on across a hemisphere, with a man who does not speak or write your language, is a difficult and unpleasant thing. Distributors were alienated. The friction arising from advertising controversies interfered with sales and service. We found ourselves giving in where we should not have given in, simply for the sake of preserving an important connection. Thus bad precedents crept in. Money was allotted for advertising that never found its way into advertising channels. A bad way of doing business, you will say, but I will defy any one with as much at stake as we had, to have done differently.

I have dwelt at some length on the matter of copy, in order that I may save time on some of the other factors. The difficulties that arose around copy typify, in a measure, the difficulties that arose around the selection of media, and the size and extent of schedules.

Theoretically, a man doing business in Australia should know what Australian advertising media to use for his advertising. Actually, that man knows no such thing, unless he is an advertising man. The same thing, by the way, holds true in this country. Our distributors by and large were not advertising men. They selected publications because they themselves read those publications, or because their friends read them, or because their wife's uncle owned them, or because the publisher was a good fellow, or because the business manager would give them a rake-off, or because their solicitor happened to drop in at the time the advertising was being placed. We found our advertising appearing in media that would not sell a car for us in a thousand years. Many distributors displayed a fondness for advertising in their own trade publications, read only by men selling the kind of things that they themselves had to sell—dealers advertising to each other, in other words. Dealers would select an absolutely worthless medium, whose circulation was confined to their own territories, and pass up an excellent medium that would actually sell cars for them, because part of that medium's circulation was in another dealer's territory. Shortsightedness, ignorance, and lack of experience controlled our list.

And the disputes and misunderstandings that arose over copy were duplicated and aggravated by the disputes that arose over media.

The differences of opinion that arose as to size and extent of campaigns were not as numerous and serious as were the other bones of contention. Nevertheless, in this respect, and in many places, conditions were not altogether satisfactory. Although we made a certain allowance per car, the amount was intended as a limit, and not as a definite recommendation. Hence, we found some distributors wasting their own money, and ours as well, simply for the purpose of absorbing the maximum allowance. One-half the amount, or two-thirds, would have been adequate. As in the case of a distributor who had a limited territory, a fairly active market, and only one inexpensive publication covering the entire market, we would find that distributor blossoming out into full page schedules, where half the space would have accomplished the maximum results.

My enumeration thus far has included only what I will call, for lack of a better phrase, the basic difficulties of our advertising arrangement at that time. There were many other accessory and supplementary difficulties. In order that our plan might work with some degree of system, and be not altogether haphazard and inefficient, a considerable amount of checking had to be done. Hence this rule: that a distributor, in order to receive his advertising allowance, must submit to us monthly clippings of his advertising, accompanied by receipted bills for the payment thereof. Hardly any distributor, it seemed to us, even after months of education and stimulation, seemed able to comply with these simple requirements. Entire campaigns would be represented by a few scattered clippings. Clippings came without receipted bills; some without bills at all. Clippings would not correspond in size with the lineage shown on the bills. Additions and extensions were wrong. Rates fluctuated, even in the course of a short campaign. Repeated urgings and warnings failed to secure monthly or regular submission of these claims; and they would all come piling in at the end of the year, or the middle of the year following their appearance. We, on our end, occasionally made mistakes; credits that should have been passed, were not passed, or the amount was incorrect. All of this entailed endless correspondence, and an increasing burden of misunderstanding and suspicion, and a decreasing amount of actual advertising efficiency.

After convincing ourselves that this particular method of handling foreign advertising was not working out in our particular case, we decided to make a radical change. We inaugurated an entirely different system—the system under which we are now working. That system is not perfect, either in itself or in our application of it, but it is at least, to our way of thinking, a decided advance over its predecessor. Again, let me say that my implied condemnation of the older plan simply applies to our experience. We could not make a "go" of it. Possibly others smarter than we can do it. It has points in its favor.

Some three or four years ago, we announced to all of our foreign distributors that at the expiration of the current season no further advertising allowances were to be made. We told them that from then on we proposed to handle our export advertising in much the same manner as we were handling our domestic advertising. We would make up a list of publications having circulation in the territories of our export distributors, and would run in those publications a consistent advertising campaign composed of advertising which we prepared ourselves. We carefully explained to them our reasons for the change, which were, briefly, as follows: We wanted to be sure that our story was being told regularly and steadily throughout our market, and told in our own words. We wanted to guard ourselves against misstatement, exaggeration, and insuffi-

ciency of statement. We were going to pay the entire cost of this venture ourselves. It was probably the significance of this last statement that smothered the fury of the reaction which we expected. Only those distributors who were obviously misusing and diverting our advertising allowance made any great protest.

So we started in, with all of the resources and ability and ingenuity at our command. We made many mistakes —some of them as ludicrous as had ever been made by our distributors. But our mistakes were not perpetuated, because we had it completely in our power to rectify these errors as fast as they were discovered. We had no differences of opinion to iron out, no long-winded and long-distance correspondence to conduct. We were treading on no one's toes and wounding no one's sensibilities.

We are still handling our foreign advertising after this manner, and we are still making mistakes, and still, in some instances, wasting money. But these mistakes and these wastes are decreasing. On the whole, every one concerned is as satisfied as one could expect a large and scattered and heterogeneous group to be.

Before going on to more discussion of our methods and experience, and the points of general information that have arisen out of them, let me say that in a few scattered instances, where circumstances seem to warrant it, we are still continuing our allowance system. These places are so few that we are able to keep them entirely under our direction and control.

Our change of plan brought with it very many problems, the discussion of which I hope will throw some light on everybody's foreign advertising problems.

First came the handling of the machinery and routine connected with an activity of this size. We decided that this could best be handled by an agency—certainly an agency acquainted with the foreign field and having established relations with the publications and having knowledge of conditions in that field, and preferably an agency located in this country.

We had many bids for our business from agencies located abroad, but we could not see where an agency located in a foreign country, when it came to placing advertising outside of that country's boundaries, would have any advantage over a similar agency located in the United States. We were not established to conduct negotiations with agencies located in each country in which we did business. We felt that the complications involved in those dealings would be equal to the complications formerly involved in dealing with each of our distributors. The responsibility would be too much divided. In many countries, of course, no reputable agencies were available. So to an agency located in this country, and familiar from long experience with the foreign field, we turned over the burden of our routine.

The next problem was the compilation of a list. For the sake of saving time and getting started, our first list was largely the work of our agency; but no sooner was advertising started in that list than we began to check up on its individual units, through our distributors, through our foreign travelers, and through all other sources of information at our command. Little by little, and here and there, it was changed—in some places expanded, in others contracted, in still other places wholesale substitutions were made.

In making such adjustments, this has been our procedure: Whenever a doubt has arisen as to the availability of a certain publication, or group of publications, for our purpose, we have gathered together from all of our sources of information, both friendly and unfriendly, all the facts that we could muster; and we have decided the issue on the weight of evidence, combined with our conception of the job we were trying to do. This process will continue, I expect, as long as we are doing foreign advertising. For conditions are constantly changing; the fortunes of various publications are constantly rising and falling; our individual problems are by no means fixed. So much for our list and its history from the beginning to the present.

Copy was the next nut to be cracked. On the question of foreign advertising copy there were, and are, as many opinions as there are individuals engaged in the production of it—plus, I might say, as many individuals as there are engaged in reading it or hearing about it. (This is equally true of domestic copy, and equally true, I believe, of all phases of advertising practice. But I don't want to get off the track on that subject.)

We attacked our copy problem, and are still attacking it, from three different angles.

FIRST: What specific purpose were we trying to accomplish aside from the general purpose—which is the general purpose of all advertising—of selling our product?

SECOND: Placing ourselves in the position of the people who were to read our advertising—half informed or misinformed or totally uninformed—what did our common sense tell us should be said in order to accomplish our immediate purpose?

THIRD: How near to, or how far from, accomplishing our purpose had the independent advertising of our distributors come, and in what way had they registered success or failure?

The first point was easy. The success of all of our advertising effort (and we have been successful, I believe, in that respect) has depended on our ability to establish for our product a certain definite reputation. I will not go into a discussion of the right or wrong of our opinions on that subject, or of the technique involved, because it is a big subject and takes us far away from the purpose of this meeting. But, assuming that our ideas on the subject of advertising copy in general were right, we could see no reason why the immediate purpose of our foreign advertising should differ from the immediate purpose of our domestic advertising.

The disposal of the second point was not so easy. There were so many things that could be talked about, and so many ways of talking about each one of them, that, with the limitations of a moderately sized advertisement and a moderately sized campaign staring us in the face, the decision of what to include and what to discard was a hard one to make. We finally decided that our campaigns should be limited to very brief, simple statements concerning these three things:

1. Brief cataloging of our product—just enough to pretty definitely locate it as to general type and position in respect to other similar products. For example, to explain what I mean, we wanted them to know it was a four-cylinder car, of a certain size, made in certain models, and with certain equipment.

2. A modest statement of those qualities which gave our product a certain reputation.

3. With an eye to establishing or promoting confidence, an indication of the age, size and reputation of our company.

Opinions may differ regarding the wisdom of our confining ourselves to these points, but nevertheless we have so confined ourselves, and the results seem to justify our decision.

Quite regardless of its merits from a propaganda standpoint, the simplicity of our copy plan commended itself from a purely practical standpoint. In the first place, it permitted considerable condensation where only limited

space was available. It was not so complicated but what it could be embodied in the kind of simple, direct phraseology that was most likely to be comprehended by the average reader. It contained the minimum of possible complications when the question of translation came up. Let me say that our copy plan, also, has undergone changes and modifications from time to time. The general idea, however, has always remained the same.

With the list and the copy out of the way, the size and extent of the campaign came up for consideration. In this, too, our decision was based on our practice in domestic advertising. We have always been believers in regular and continuous advertising, as opposed to variable and irregular advertising. Our foreign campaigns have always been consistent and regular. We have taken the amount of money available for advertising in any given country, and spent it in the largest, consistent, regular campaign that it would buy; the amount of money available limiting the maximum size of space; common sense and the determination of what was necessary to command attention limiting the minimum size of space. For example, generally speaking, we prefer twelve half pages in a monthly publication to six full pages. This is not an entirely good example, because other considerations might affect our procedure; but I am sure that you get the idea.

So much for the fundamentals of our present plan of foreign advertising, and what preceded and led up to it. But there are other little side issues that are almost as important as the fundamentals themselves. Take the matter of what constitutes eligibility in a publication for inclusion in our list. We have found that, considering the limits of a modest appropriation, the best results are obtained from publications of general circulation, locating their circulation, insofar as may be, among the classes most likely to purchase our goods. This is in the nature of advertising first principles, and requires no elaboration. Where general publications of proper character are not available, we are driven to something more local. We have no objection to the more localized publication, such as newspapers, except that the use of them usually involves the expenditure of a great deal more money than is available. More of them have to be used. While they may carry our message closer home, and spread it more thickly, we cannot afford, nor do we need, in normal times, to cultivate our foreign market thus intensively and extensively.

It must be borne in mind that we are not producing goods exclusively for the foreign market. A certain volume must of necessity be maintained at home. The intensity of our foreign merchandising must be determined by the quantity of our goods that we decide to allot to the foreign field.

I will admit that at present, along with most every one else, we could allot to the foreign field much more of our product than they are taking; but I am speaking of normal times under normal conditions.

A foreign advertising appropriation is not an easy thing to determine. We are not entirely satisfied with our method; but this is it. We base our total advertising appropriation, domestic and foreign, on the amount of goods we plan to produce in a given year, influenced and modified by the amount of sales resistance we expect to encounter, and we allot to the foreign field, generally speaking, an amount in proportion to the number of units we plan to sell abroad.

There is one question which may be in the minds of some of you, the answer to which I did not consider in its proper place because it seemed to break the continuity of the discussion, and that is this: "Are you not, by financing your big foreign advertising campaign out of your own pocket, encouraging your foreign distributors to lie down on their end of the merchandising job?" We are, unless steps are being taken to counteract the influence. Those steps are being taken.

We are telling our foreign distributors that our advertising in their respective territories is in the nature of general reputation-building propaganda, such as we carry on in this country in our magazines of general circulation; and that they, too, like our domestic distributors, must see to it that their immediate local markets do not remain uncultivated. We are suggesting, and that suggestion is rapidly developing into a demand, that they spend in their territory a sum equal, if not greater, than we spend in that same territory.

While our advertising is opening up and developing their market in a broad, general way, their advertising should be cultivating and re-cultivating that same market. We are meeting with a marked degree of success, and I predict that when things open up again abroad in a big way, we shall be able to do infinitely more than we have done in this respect.

In conclusion, let me offer this apology, if such an apology is necessary. The purpose of the addresses and discussion at this convention is to promote the dissemination of general information—the kind of information that can be assimilated and used by concerns marketing widely differing products under widely differing conditions. In the light of this, it may seem as though my discussion were too closely confined to personal experiences, in a particular line of merchandising. But, after all, what real information can one man give to another man except information gathered from his own experience? All other kinds of general information can be gathered from books, and reports, and the experiences of other men. The only thing that an individual has that is really his own, is his own reactions and conclusions, based upon his own experience. If his reactions and conclusions differ in no way from those of other men undergoing similar experiences, he can at least throw them in to swell the average and help establish a rule. If they differ in some respects, they should be, in that degree at least, informative. Although my experience has been largely a specialized one, I have tried to draw from it only those conclusions that seem to me in some way pertinent to the subject of foreign advertising in general.

One more word: There are many stages in the process of development which I have described, that from necessity had to be omitted. There are kinks and angles of our present plan that could not be included for the same reasons. If you can think of any of these, and if the brief discussion of them will be interesting to you, I hope you will not fail to bring them up in the general discussion which is to follow.

British Motorcycle Registrations

JUDGING on the basis of figures available at present, it would seem that the United States has a considerably larger number of motorcycles in use than Great Britain. Under the new British registration law it will be possible for the first time to determine exactly the number of motorcycles and automobiles in use in the British Isles. There have been 186,000 motorcycles registered up to March 1, while authoritative estimates place the total which will be reached when all the machines get on the road for the year at about 200,000.

This is considerably below the American registration of last year, which was 234,000. In this country, moreover, there are undoubtedly many thousands of motorcycles which are never officially registered.

The Possibility of Developing Leaders

The older leaders received their business education when business was small and when rules and regulations were few. Present methods tend to remove from the individual the necessity for judgment. Consequently competent leaders are not being developed as rapidly as they are needed.

By Harry Tipper

FROM time to time we have considered the question of standardized method of dealing with human relations in industry, the adoption of many rules of selection, examination and training, and the danger of uniformity. The matter cannot be stressed too strongly.

Year after year in my lecture work at the New York University some student has asked continually for a rule governing this point in human action or that point. He is not willing to spend the time and labor necessary to discover the fundamentals, digest and understand the principles. What he wants is an educational pill which will work while his intellect sleeps, and give him a solution of the problem.

The biggest job for the man who lectures to such young men is the job of awakening the mind to thought, so that it will get some measure of understanding. In human affairs there is no uniform problem. There is an infinite variation in the individual quality, action and expressed capacity.

The individual differences and the friction of activity arising from the differences are the bases of improvement. We have already molded men's work by system, rule and regulation to the point where there exists an undesirable uniformity in their surroundings. In the minds of many men who are concerned with industrial relations, either in industry or out of industry, the idea of further uniformity, miscalled standardization, is the ideal toward which they strive.

Until we are clearly informed as to the principles upon which human action depends we cannot standardize, because such principles themselves are the only standards by which a measure can be made.

The laws of physics are the basis for all mechanical calculations, and out of them grow the other formulæ with which we shorten the time of our calculations and improve the quantity of work. Without a knowledge of these laws the formulæ themselves would be impossible.

So-called standards of examination for quality, fitness for work and character reading are entirely arbitrary and simply relieve the man who is charged with the responsibility from the amount of study and labor necessary to a proper examination of the individual. Obviously they cannot take count of the infinite variety and the effect which this variation has upon the individual quality and capacity. Skill can be measured because of its tangible result. Quality, character and capacity cannot be measured because the fundamentals out of which they grow are not clearly understood, and the infinite variety of their development and expression can only be determined by a study of each individual.

There is a general complaint through industry that we are not breeding leaders; in the movement of subordinate executives to the places of larger responsibility we find them hidebound by rule and regulation, limited in knowledge beyond the scope of their special skill, and unable to meet changes in condition with courage, firmness of action and self-reliance.

The agent of a hundred years ago who represented his principal in a city a thousand miles away from the office was in effect entirely responsible for all the operations, the decisions and the developments within his sphere of action.

If we quote from the records of such a merchant we find: "Upon my return to this territory, after three years' absence, I was pleased to find that my agent had invested the monies I left with him to such advantage in the business and in other enterprises that they had yielded me a handsome profit, which he delivered to me upon my arrival."

This man was for months without any knowledge of the operations of his agent, the adventures which the agent had undertaken or the purpose to which the funds had been devoted. Communication and transportation were very difficult, the machinery of commerce was very cumbersome, and, as a consequence, there could be no centralized control. To-day the rapidity of communication, the effectiveness of transportation and the unified systems of mass operation enable the control to be centered in the hands of a few to such a degree that the responsibility of the subordinate supervisors is extremely limited and definitely bounded by rule and regulation.

The decisions to be made by these men are governed by the system laid down. In many instances they are governed in extreme detail. This discourages the development of the capacity for decision, limits the knowledge to the specialized series of operations under the immediate supervision and destroys, rather than develops, the capacity for wise leadership.

Not long ago I was in conference with the president of a large company employing many thousand men. We were talking about some obvious deficiencies in various departments of the organization. The president of this company asked me what, in my opinion, was the important reason for the defects.

In reply I said, "Most of your supervisors are not leaders; they are only skillful operators, and consequently they do not know how to handle men."

His reply was illuminating, he said, "You are probably right, Tipper; but we have to have a thousand supervisors; where can you find me a thousand leaders?"

It is interesting to note that most of the older leaders in business, whose wisdom and vision have been acknowledged and whose capacity was outstanding, received their education in business at a time when business in this country was small, the

rules and regulations were few and the powerful, centralized systems of control were not established.

These men grew out of the very opposite conditions of business from those which they left at the close of their career, without realizing the effect of the change upon the capacity of the younger executive.

It is not without interest that lawyers, newspaper men and energetic, dissatisfied men from many lines of industry have been responsible for the growth of the automobile, advertising and other new developments. In these new lines they have a sphere for decisive action, developments which permit them to govern the system instead of obeying a system already established.

Because these highly centralized, controlled, detailed systems of operation in industry and commerce tend to decrease the capacity for leadership among the supervisors there is a great necessity for a broader and more fundamental type of education to the supervisors, a better acquaintance with the structure and elements of business, more encouragement by the decentralizing process and more incentive for the improvement of their own departments by the allowance of flexibility in the interpretation of the system.

In many concerns salesmen are obliged to fill out a report blank so cumbersome in its detailed formality that it clogs any inspiration. Results as to calls, routing over the territory, methods of approach and so forth have gone so far that in some organizations the actual words of a solicitation are rehearsed and standardized. Similarly in the factory side of business, the systems under which the foremen and department heads are required to work are formally determined in such detail as to require little or nothing but obedience to these uniform developments. These things do not make for the education of supervisors into leaders.

There is little or no opportunity for the exercise of judgment, for the quality of decision or the expression of human understanding. Consequently we are crying for leaders, executives and men of understanding in industry to fill the places of those who pass out, most of whom were educated under a free industry and developed by the necessity for continuous decision and responsibility for action.

Meeting of German Automobile Manufacturers' Society

THE Society of German Motor Car Manufacturers held its annual meeting at Berlin recently. Dr. Sperling, the general secretary, made a report in which he referred to the fact that during the war productive capacity had increased enormously in all countries, whereas the sales possibilities had shrunk greatly. After numerous appeals to the Government the control of the sale of gasoline had been discontinued, but in view of the deliveries required by the Entente the sale of benzol could not yet be freed of control by the Government.

The Society co-operated with the National Committee on Aerial and Motor Vehicle Transport with a view to the revision of the motor vehicle law of Feb. 3, 1910, with the result that already the regulations regarding admission of types, the hauling of trailers, test runs and the trailing of drivers had been materially eased. Other matters under consideration were a revision of the lighting and warning signal requirements and the admission of small motorcycles.

Referring to the readjustment of prices, the speaker said that automobile prices had increased less in proportion than prices of raw materials, and the Society had begun negotiations with the raw material associations which were still pending, as without a decrease in the cost of raw materials it was impossible to reduce the prices of automobiles, as present prices barely covered the cost of production. Under these conditions it was impossible for the automobile manufacturers to meet requests sometimes made of them to fill old contracts at the agreed prices and that the Supreme Court in several decisions had agreed with this view of the matter.

In response to urgent requests of the Society during the past year the national government provisionally removed the export tax, in order to enable German manufacturers to compete in foreign markets. The export tax planned by the Entente would, it was said, absolutely exclude German motor cars, cycles and accessories from Entente markets and must therefore be declared unacceptable.

It was unanimously decided to hold an automobile show the coming fall. A resolution of protest was adopted against the proposed increase in the tax on motor cars and trucks. Finally Dr. Sperling reported on import and export policies, referring particularly to the closing of neutral and Entente markets by embargoes or excessive duties which in their effects were similar.

Flame Characteristics and Their Influence Upon Combustion

(*Continued from page* 1102)

ionized by some of the catalytic processes. Great turbulence also accelerates inflammation and aids in keeping temperatures down by the scrubbing action of the burning gases upon the cold walls. To decrease the noise of detonation and to prevent extremes of temperature the combustion-chamber should be without pockets and very compact, *but without parallel surfaces*, so that neither heat nor sound can be concentrated by reverberatory action. The spark-plug should be located so as to give the flames the shortest possible travel.

It is likely that kerosene and gasoline can be more effectively burned by so stratifying the mixture that ignition occurs in a very rich portion which burns out into an excess of air, or a supporting atmosphere. If properly done detonation could not occur as the fuel would occupy but a small place in the combustion-chamber. Being a very rich mixture the rate of inflammation would be high. Complete dissociation would not be likely to occur and could not cause auto-ignition if it did, as there would be very little opaque vapor beyond the flame-front. A well vaporized, very rich mixture burns first blue, then green, the green indicating a cracking into new smaller hydrocarbons. If enough air is available immediately after the cracking the green flame becomes blue again and is in no way objectionable except that it is about 50 per cent more radiant than the blue flame. With this method the air is not throttled; the fuel only is governed. An engine using this method of combustion would have steam-engine characteristics in a reasonable degree, without sacrificing economy, which is much more than can be said for present engines.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
Reg. U. S. Pat. Off.

PUBLISHED WEEKLY

Vol. XLIV Thursday, May 26, 1921 No. 21

THE CLASS JOURNAL COMPANY
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Owned by United Publishers Corporation, Address 239 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; A. C. Pearson, Treasurer; Fritz J. Frank, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of Associated Business Papers, Inc.

Member of the Audit Bureau of Circulations.

Automotive Industries—The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly) July, 1907.

A Highway Platform

THE resolution on highways adopted by the Chamber of Commerce of the United States is a clear, direct statement of a reasonable highway platform. It is here printed:

"The importance of improved highways has already had recognition by the Chamber, and the highway development in the country has attracted wide attention. In order that funds now to be spent for highway construction may adequately serve the economic purposes which are becoming clearly recognized, the following fundamental principles should govern:

"Bonds should be issued by states and territories, counties or municipalities and Federal assistance furnished only for portions of highway construction which are reasonably enduring and permanent in character.

"Federal appropriations should be made only for assistance to state highways which will become a part of an interstate system.

"Federal assistance should be continued only to those states which adequately maintain highways for which there has been Federal aid.

"Most careful study should be made by the Federal Government, in co-operation with State governments, as to routes, the probable character of service over such routes, and the best form of construction to meet such service. These studies should include ultimate economies of location and design."

The S. A. E. Summer Meeting Papers

THIS editorial, written in advance of the semi-annual meeting of the Society of Automotive Engineers, but after opportunity has been given to read several of the papers to be presented, is to advise engineers who are prevented from attending the meeting not to overlook the valuable information contained in the papers contributed to the program. A number of the latter deal with the fuel problem or closely related subjects and add much useful information to that published as a result of research and reports made at earlier meetings. The current papers, some of which appear in this issue or will appear in later numbers of AUTOMOTIVE INDUSTRIES, are, on the whole, rather more specific than in many of the earlier papers on fuel subjects, indicating that much-needed data is being secured and that ideas heretofore expressed are beginning to take a more definite form.

As usual, the Bureau of Standards has contributed largely to the program, and the data contained in the paper by W. S. James, with its appendices by other members of the bureau's staff, are pertinent and of exceptional value in pointing out weaknesses in present designs of automotive equipment and in many other ways.

The discussion by Dr. H. C. Dickinson on the present status of knowledge regarding the so-called "knock" phenomena should help clarify and correlate in the minds of many interested the various more or less hazy theories in this regard which have been advanced from time to time.

The number of papers dealing with research are a pleasing indication of the increasing importance attached to this vital phase of engineering and industrial progress. If the appreciation of work of this character continues to grow at the present rate, and especially if executives come more and more to understand its value and see that it is adequately supported, it is safe to predict astounding progress in automotive development—a development that seems certain to maintain the commanding position which the automotive industry now holds as being the most progressive of all the great industries of to-day.

Help Secretary Hoover

IT is extremely interesting to note the friendly attitude of Congress toward increased appropriations for Secretary Hoover's proposed work in the promotion of business in this country and for export.

Secretary Hoover's ideas as to the function of the Department of Commerce are sound. His ideas of

gathering production data and publishing it for the benefit of all business interested is an especially good move at this time. Within the last few months a State investigating committee working in New York has shown that there is much secret gathering of data going on in some of the building trades and that the data so gathered is used exclusively for the purpose of maintaining prices by those firms which belong to the particular organization gathering these data. This plan is workable merely because these figures have not been otherwise gathered and published.

It would be well for the men concerned in the automotive industry to urge upon their congressmen the need for more intelligent data in business. A congressman is likely not to appreciate the importance of such figures. Perhaps he has never studied sales building. A letter to him from a manufacturer is likely to be very illuminating on this subject. There is no reason why the automotive industry should not court the fullest publicity, as it has nothing to hide.

Perhaps if the manufacturers would stop to think how much data can be gathered for the amount necessary to build one 16-inch gun, they would be better able to make a definite argument to the lawmaker to whom they write. Manufacturers should be quick to take advantage of the sales statistics figures that Secretary Hoover proposes to offer to them.

Loose Tax Talk

IT seems more than passing strange that the railroads, after a period of quiet, should again bring forth so prominently the cry against the motor truck running on public highways without paying a high tax for the privilege of doing so. This sentiment, which has often appeared in railroad literature of late, became the prominent feature of Julius Kruttschnitt's testimony before the Senate Committee on Interstate Commerce.

One would hardly believe that the chairman of the Southern Pacific or any other western railroad would enter much of a protest against public aid to transportation in the interest of the development of the country. Certainly the western railroads have profited by public lands and funds.

But why this constant and everlasting dispute as to the use of the highways and who pays for their use? The people of the country, in their tax bills, supply the money for the building of the highways. The motor vehicle owners pay a special tax for the maintenance of the highways—or at least that is what the money should be used for. If special interests are taxed for the use of these highways, it merely means that this special interest will add this tax money to the price of the product hauled and in that way get it away from the mass of the people. In passing on this tax the special interest will take its toll coming and going. So the bill paid by the consumer mounts.

Does anyone suppose that if one of the large oil companies is compelled to pay additional truck license fees of $1,000,000 a year that this company will not raise the price of kerosene? And make an additional profit on the advance? If there is any such person—but why go on?

Why should a fleet owner, who handles his transportation units efficiently and moves freight economically for the benefit of the people, be taxed merely because railroad management is so inefficient and because the railroad equipment belongs to a day that has passed?

How can this country advance if progress is to be taxed to enable the business of yesterday to pay a profit? It would be just as reasonable for Mr. Kruttschnitt to advocate a return to earth roads and ox-carts and to sailing vessels, so that his road can have a monopoly of freight haul. Why not a rule of reason as to motor vehicle taxes?

Inaccurate Statistics

THERE appears to be an epidemic of articles being circulated and printed about the automotive industry that are based on figures that are weird and wonderful. Where these figures are obtained is impossible to state. They are not the figures compiled by the N. A. C. C., the several Government bureaus nor by AUTOMOTIVE INDUSTRIES. One of these articles was recently submitted to the Society of Automotive Engineers by a manufacturer for the program at the semi-annual meeting at West Baden. This paper was carefully read by the S. A. E. papers committee and rejected because of wrong figures used to reach conclusions. Later this paper was printed in the main in *The Annalist* of New York and, since its printing there, has been distributed to the press by an advertising agency. What reason either the writer of the paper or the agency may have for attacking the industry through inaccurate figures is not apparent. An article based on correct figures would be just as effective in promoting the use of alloy steel.

Benefits of Leadership

WHEN a supervisor, foreman or executive possesses the power of the well-known centurion of the Bible, he is strongly tempted to exercise that power without regard to its ultimate effects. Why take the time and trouble necessary to lead a group of workers when all you really have to do is to tell them?

There is one purely selfish reason, besides other more altruistic ones. There is always likely to come a time when the balance of power is changed. The supervisor may want the workers to do something that they do not have to do unless they so desire. If he is a leader and has been in the habit of leading them in small things, they will voluntarily follow him in the big things as well. But if they have done his bidding merely because of necessity, they are almost certain to exercise their power when the tables are turned. Some such psychological reaction is responsible for many of the labor troubles of the last few years. Intelligent handling can prevent its being responsible for future difficulties of a similar nature. The present time is favorable to the study of this problem. Leaders will be needed in the future; their development can begin now.

Bank Reserves Ample, Harding Says

Credit Situation Again Near Normal

Reserve Board Head Urges Business on Substantial Lines—Defends Bank Forms

KANSAS CITY, May 23—Governor Harding of the Federal Reserve Board came to Kansas City Saturday as the guest of the Kansas City Motor Car Dealers' Association. In two conferences with directors of the association and representatives of the industry from the various states of the Tenth Federal Reserve District and in an address to 350 bankers and automotive distributors of the district, the Governor declared that methods of handling paper offered for rediscount could now be changed in view of the strong situation of the Federal Reserve Bank. **He implied that individual banks were also in unusually strong position, and could doubtless modify the restrictions they had been making.**

Governor Harding went so far as to urge aggressive merchandising, and there was more than a hint that the conditions of banks offered a welcome to borrowers for legitimate business purposes. There was also more than a hint that among these borrowers, especially among those whose papers would be acceptable to all Federal Reserve Banks, was the automotive industry. Governor Harding did not explicitly declare that motor car paper would now be rediscounted at all Reserve Banks, but he gave suggestions to the distributors present on preparing forms in such a way that their paper could be handled with a minimum of delay in rediscounting processes. The explicit prediction that paper heretofore not accepted for rediscount might soon be accepted was made by Governor Miller of the Kansas City Bank, the Federal Reserve Bank of the Tenth District, which has not rediscounted motor car paper for many months.

Meet in Conference

Governor Harding was met by the directors of the Kansas City association at the train Saturday morning. At breakfast and during the motor car ride following with the distributors and again in the afternoon Governor Harding discussed with the dealers the relation of the Federal Reserve Banks to the automotive industry. The afternoon conference included representatives of automotive associations from many States. Governor Harding spoke at the City Club at noon; outlining the financial history of the past two years. His main address was at the dinner in the Muehlbach Hotel given by the Kansas City Motor Car Dealers' Association in his honor, at which 350 local and territory bankers and automotive distributors of passenger cars, trucks and tractors were present. E. E. Peake opened the meeting, John B. Butler, president of the Kansas City association, acting as toastmaster. The governors and chairmen of the Federal Reserve Banks of San Francisco and Minneapolis, who had come to Kansas City for conferences with Governor Harding, were introduced. The toastmaster then called on J. Z. Miller,

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New Goodyear President a Schlesinger Protege

MILWAUKEE, May 23—Edward G. Wilmer of Milwaukee, who on May 17 assumed charge of the Goodyear Rubber & Tire Co. of Akron as president, has been for several years regarded as one of the coming leaders of business and finance in American affairs. He is 38 years old and a graduate in law at George Washington University, Washington, D. C., but he never has devoted himself to exclusive practice.

Upon being graduated, about twelve years ago, Wilmer was engaged by the late Ferdinand Schlesinger of Milwaukee, one of the most prominent figures in the American iron, steel and chemical industries, as a personal adviser and legal representative. Wilmer rose rapidly and became one of the most prominent men in the vast Schlesinger enterprises, serving as vice-president of the Steel & Tube Co. of America, a consolidation of a dozen large concerns; the Newport Co., one of the largest chemical concerns in the world, and the Milwaukee Coke & Gas Co. He is regarded as one of the keenest business executives, particularly in financing, that this country has produced in the last decade.

His accession to the presidency of one of the world's largest rubber and tire concerns is recognition of this remarkable ability. It also is significant of the entrance of the vast Schlesinger interests into a new field and a financial participation in the reorganization of the Goodyear company, which is backed by a historic record in iron, steel and chemicals.

THOMART TRUCK CUT $690

KENT, OHIO, May 21—The Thomart Motor Co. announces a reduction of $690 in the price of the Akron multi-truck chassis, making it $1,995, f.o.b. Kent. The explanation is made by W. G. Thompson, president of the company, that the company's inventory has been liquidated and that production costs have been reduced to such a point that a lower price is justified.

Parts Orders Drop in Last of Month

Factories Report Hold Up in June Releases—Price Uncertainty Held Cause

NEW YORK, May 25—Uncertainties in regard to retail market conditions are leading manufacturers of motor vehicles to proceed with extreme caution in making commitments for materials. This fact is disclosed by reports made by the leading motor and accessory manufacturers of the country.

The total of business for May probably will equal that of April, but it was heavier for the first two weeks than for the first half of last month. Since that time many releases have been countermanded and there have been a few cancellations of new orders. Indications now are that the volume of business for June will not equal this month. A considerable number of June releases have been held up in the last ten days.

While orders for supplies are showing a tendency to decline, however, collections for May have been better than at any time since the slump began. The gratifying improvement recorded in April has continued and in numberless cases past due accounts have been liquidated. There has been heavy liquidation in the last three months in the current indebtedness of automobile manufacturers, and there is no evidence that payment of obligations in future will be any less prompt.

Although parts makers have felt a slowing up in business from vehicle manufacturers, there has been no slump whatever in the trade with jobbers and wholesalers. In fact, it has steadily continued its upward trend, and June promises to be better than May. Collections in this branch of the trade are excellent.

It is evident car and truck makers are determined not to pile up inventories. The experience of last summer in this direction has made them exceedingly wary. They are buying on a hand-to-mouth basis to meet only immediate needs. The falling off in orders from them is bound up closely in the question of price cuts.

Lines which have not cut have suffered a sharp decline in sales, while those which have made reductions this spring have felt a marked rebound. The buying public seems to take no further account of price reductions made last fall. The market is decidedly jumpy and gives every evidence of needing the stabilizing influence which would come with immediate determination by manu-

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Dealers Protest Excise Tax Burden

Senators Are Told Why Levy Is Unfair

Harry Harper Spokesman for N. A. D. A. Committee—Strong Arguments Presented

WASHINGTON, May 23—Vigorous protest against the assessment of proposed increases in the excise taxes on automobiles and other forms of discrimination was made here to-day by the National Automobile Dealers' Association in presenting its recommendations for internal revenue revision to the Senate Committee on Finance. It expressed the belief that any further addition in taxes upon the motor vehicle would have to be borne in large measure by the dealers and that the sales resistance engendered by such increase would seriously jeopardize the success, progress and prosperity of the entire industry. While the general tax program of the Association is in harmony with the plan of the National Automobile Chamber of Commerce, its argument differed in that it showed the harmful tendencies of present and proposed taxes from the standpoint of the dealer.

The case of the organized dealers was presented by H. B. Harper, chairman of the association's taxation committee. The Senate committee listened attentively and there were few questions to interrupt his speech. He escaped the grilling which the committee forced upon witnesses for the manufacturers.

Harper pointed out to the committee that the interests of the dealers are separate and distinct from those of manufacturers. He said that dealers are large tax-payers in their own communities in addition to taxes paid to the Federal Government: excise, excess-profits and income taxes. It was his contention that the automobile industry as a whole is not protesting against its fair share of taxes but believed it was time for a more equitable distribution of the tax burden to other commodities and trades.

Dealer Mortality Highest

As to the reported profits of automobile dealers, Harper directed the attention of the committee to the fact that the average dealer nets a profit of between 3.5 per cent and 4.5 per cent of his gross sales. He laid emphasis upon the contention that "in no other American industry is the mortality so high as among automobile retailers. Hundreds of dealers, in order to stimulate the sales that have fallen off so noticeably in the last six or eight months, are absorbing the tax and the handling charge and in addition, in 90 per cent of all sales they are taking in a used car for considerably more than its value in order to sell, mainly for the sake of keeping their organizations moving and looking forward to a betterment of business conditions."

To establish the fact that the automobile is essential, the spokesman declared that it is a business car first and foremost and any recreational uses it may have are but incidental to its primary purpose, which is personal transportation. Sixty per cent of all automobile mileage is for business purposes. Ninety per cent of all automobiles are used, more or less, in business. Instead of being a burden upon its owner, the automobile has added 57 per cent to the productivity and effectiveness to the average automobile owner.

Denial was made of the theory that a tax on automobiles is to pay for surplus wealth. Harper said: "The tax

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Business Paper Editor to Be Hoover Assistant

NEW YORK, May 21—Fred M. Feiker, vice-president of the McGraw-Hill Co., Inc., and one of the best known men in the business paper field, has been appointed assistant to Secretary of Commerce Hoover, to assist the department in effecting a contact with business. The Secretary is also holding monthly conferences with the National Conference of Business Paper Editors, with which work Feiker has been very active.

Feiker has been engaged in business paper work for fourteen years. He received an electrical engineering degree at Worcester Polytechnic Institute in 1904, was two years in the technical publicity department of the General Electric Co., went with the Shaw papers to start *Factory* and became chairman of the editorial board, remaining eight years with Shaw. He then joined the McGraw-Hill Co. as editor of *Electrical World*, and became vice-president of the company.

He has secured a leave of absence of several months from the McGraw-Hill Co., with which he has been for six years, and expects to begin his work with Hoover before June 1.

LEACH OFFICERS RENAMED

LOS ANGELES, May 23—M. A. Leach was re-elected president and all members of the board of directors also were renamed at the annual meeting of the stockholders of the Leach Biltwell Motor Co. Other officers also were re-elected. More than two-thirds of the stockholders were present. Financial reports showed that the company had successfully weathered the depression.

Canada Tax Finds Favor of Dealers

Domestic Made Vehicles Will Be Benefited Over United States Products

TORONTO, May 21—Realizing the Government's need of revenue, the motor manufacturers, importers, distributors and dealers are not disposed to adversely criticize the budget. The importers of United States cars and trucks are faced with a considerably greater additional impost than the distributors and dealers in domestic made motor vehicles for not only do they face a doubling up of the sales tax, but also an increase in duty arising out of the new basis of its determination—the United States price plus exchange.

They are naturally not jubilant over the change, especially as it slightly increases the differential in favor of Canadian-made cars and trucks. However, this offsets the advantage given the importers under the initial imposition of the so-called sales tax.

On the whole, the automotive trade and industry is delighted that automotive products have not been singled out for special taxation, especially as this is generally believed to indicate an appreciation by the Government of the fact that motor vehicles are no longer luxuries or non-essential, but utilitarian necessities—the greatest of time and labor-saving devices.

In giving the lie to wildcat rumors to the effect that extortionate taxes were to be imposed—rumors that carried with them the assurance that they were inspired by authorities in the confidence of the Government—the budget relieved the minds of many who lent these rumors credence, of apprehensive tension and anticipatory worry.

The duty now applies on the United States manufacturers' price plus exchange at time of shipment, and the sales tax applies on the resultant. Comparatively, however, the prices of cars have not been much advanced, and some not at all.

ADD EMBEZZLEMENT TO THEFT

WASHINGTON, May 23 — Senator Nelson's bill amending the "Act to punish transportation of stolen motor vehicles in interstate or foreign commerce," was passed by the Senate without change. The amendment adds the word "embezzlement" so as to include not only cases where the automobile is stolen but as well cases of embezzlement. It relates to transportation of embezzled property in interstate, not in state commerce.

Willys's Cars Join in New Price Cuts

Overland Down to New Low Point—Knight Drops $300—Scripps Off $250

TOLEDO, May 20—Willys-Overland and Willys-Knight have announced price reductions effective June 1 constituting the second drop in Overland cars within the last year, totaling 33 per cent from the price last summer. Open models now selling at $895 are reduced to $695, coupe from $1425 to $1000, and the sedan from $1475 to $1275. Willys-Knight prices for the touring car are reduced from $2195 to $1895 and the same reduction is made on the roadster. The coupe was reduced from $2845 to $2550 and the sedan from $2945 to $2750.

The new price on Overlands is $150 less than the lowest price for which this car ever sold. It is made possible, according to John N. Willys, by the sale of the car which already has passed the 140,000 mark and by the anticipation of the great saving through increased factory efficiency, manufacturing cost and increased volume.

"We have decided to anticipate every possible saving and are setting our prices at rock bottom June 1," said Willys. "We are going the whole route right now. The price is one which we have long anticipated we might some day reach in Overlands and the car itself is better than ever. At present we will take a loss on every Overland we sell, but expect to make this up in increased volume and increased material saving."

Scripps Reduction $250

DETROIT, May 21—The Scripps-Booth Corp. announces a price cut averaging $250, effective to-day. Prices for the touring car are $1,295, roadster $1,275, coupe $1,950, sedan $2,100. This is a decrease on the touring car of $250, roadster $270, coupe $265 and sedan $195. This is the first cut for Scripps-Booth, but the company did not increase prices when others did last spring and summer.

Ford Discontinues Bonus; Will Increase Wages

DETROIT, May 20—The Ford Motor Co. has abolished the yearly bonus, according to the Ford *News*, its official organ, and in lieu thereof has increased wages in an amount aggregating what each employee would receive annually under the bonus system. This is paid in 26 installments on the regular semi-monthly pay day. Announcement was made this week that the bonus was being paid in installments in order to protect men leaving before the end of the year. The *News*, however, corrects the announcement and states it is designed as a wage increase and applies to every man on the payroll May 1.

The statement also says the plan to supplant the bonus was decided on last January, and all employees on the roll May 1, who have been working since the plant reopened in February, will receive back pay in an amount equal to the difference between the wages already received and the amount they would have received under the increased wage plan.

In order that every employee may understand the bonus has been discontinued and know what his increased rate will be, together with the number of back payroll hours to which he is entitled, cards bearing the information are being inserted in pay envelopes. Men employed since May 1 are being paid the standard rate, which the *News* says provides a minimum of 75 cents an hour. Discontinuance of the bonus does not affect the investment plan under which employees may invest up to one-third of their wages.

Paige Report to Show Satisfactory Earnings

DETROIT, May 21—The annual report of the Paige-Detroit Motor Car Co. is now being prepared and is expected to show satisfactory earnings. In the first quarter of 1921 Paige shipped 3004 cars, against 4755 the first quarter of 1920. Since the first of the year the company has paid off all supply bills and is in a position to discount all its bills. Its bank balances are around $1,000,000 and bank loans have been cut in half. The company now is operating on a 60 per cent basis, turning out between 50 and 60 passenger cars a day. The reduction in production schedules was ordered in anticipation of unsettled market conditions. Best sales conditions are found in New England, New York and Pennsylvania, with Ohio, Indiana and Wisconsin coming next.

Employment Drops Off First Time in Months

DETROIT, May 20—A net decrease of 1776 men employed was shown by the labor report of the employers' association here today. It was the first week the employment situation had not improved by several thousand since the industrial revival began. The 79 member firms now employ 116,721 workers.

TRUCKS NOW SECOND CLASS

NEW YORK, May 23—The traffic department of the National Automobile Chamber of Commerce has been advised by the chairman of the western classification committee that favorable action has been taken on the request for reclassification of motor trucks and chassis shipped in carload lots west of Chicago and the Mississippi River. This classification will be changed from first class to second class. The consequent saving in freight charges on a 15,000 lb. load of trucks will amount to $35.35 on shipments to Kansas City or Omaha; $68.25 to Dallas, Galveston and Houston, and $88.50 to Denver with other western points in proportion. Pacific Coast rates are not changed.

Used Cars Pile Up as New Sales Grow

Coast Business 85 Per Cent Trade-Ins—Lower Gasoline Stimulates Demand

SACRAMENTO, CAL., May 23—Developments of the spring have worked for the benefit of motor car dealers here, generally speaking. Business has returned to a semblance of pre-war conditions, although disturbing factors have not been wanting.

One of these is the recent price drops of some cars. These have worked to the advantage of the dealers in these lines, but on the other hand, have caused some little difficulty among would-be purchasers of other makes, who show a tendency to hold off in the hopes of more price cutting.

The reduction in the price of gasoline, coupled with the announcement that there is plenty of motor fuel in sight for the summer, has stimulated sales. The uncertainty of gasoline last year was a very disturbing factor to the trade here.

The used car market is sluggish. Second-hand cars are piling up, as 85 per cent of the sales here are estimated to be trades for old cars. Vacant lots about the city are being used to store and display these used cars, which are the chief concern of the dealers.

The Miller Automobile Co., Dodge dealers here, have instituted the practice of rebuilding all used cars taken in, turning them out with a "Maco" guarantee. This has been quite successful, as has also the plan of the Sacramento Buick Co. along the same lines, in rebuilding, repainting and retopping its used cars and selling them with a new-car guarantee.

Pointing out that the buyer of a used car saves the dealer's profit, war tax and freight charges, the latter not inconsiderable in this territory, these two firms have been keeping their used car departments quite clear of any undue accumulation of second-hand automobiles.

CHEVROLET MOVES OFFICES

NEW YORK, May 20—The production, material, purchasing, traffic, engineering and production and plant engineering departments of the Chevrolet Motor Co. have been moved to Detroit on April 15 and will be located in the General Motors Building. These departments will be under the general direction of K. T. Keller, manager of manufacturing. The offices of the general manager and of the general sales and accounting departments remain in New York.

INDORSE RETURN GOODS CHARGE

CHICAGO, May 20—The Midwest Rubber Manufacturers' Association at its meeting here adopted a resolution recommending that a minimum charge of 5 per cent be imposed on merchandise returned for credit or exchange or on the shipment of new goods.

Price Concessions Necessary, Says Bank

Appreciation of Reductions Will Stimulate Business, Declares Wisconsin Institution

MILWAUKEE, May 23—"There is some uncertainty as to whether or not the improvement in the motor car industry is permanent," says the May issue of *Business and Financial Comment*, issued monthly by the First Wisconsin National, the largest bank in Milwaukee. "Judging from recent and somewhat radical reductions in the prices of passenger cars and tires, concessions were found necessary to stimulate new business and hold the ground gained early in the year. So far as Milwaukee is concerned, the automotive equipment industry did not gain as much in the past month as in the previous month. Orders were more numerous, but probably ruled 50 per cent below the corresponding month in 1920. Operations are running on the average from 45 to 55 per cent. The trend of prices is regarded as uncertain."

Speaking of the Milwaukee metal trades, the report says: "The metal trade shops, with the exception of those supplying the automotive industries, practically marked time during the past month. All lines using iron and steel are clouded with uncertainty and improvement is contingent upon wages and prices in the basic industries. Machine shops of all descriptions in Milwaukee are probably operating on the average of not more than 40 per cent. Certain firms supplying machinery for road making, oil production and the automotive market make a better showing. In the steel industry at large, sheets and structural materials for building make up the greater proportion of the available business."

In the last week to ten days a number of passenger car manufacturers in and near Milwaukee have reduced production schedules because of the accumulation of finished products resulting from a decline in distributers' and dealers' orders in the first half of May, largely because of adverse weather conditions. This is believed, however, to be only a temporary matter, as new business is again developing more actively.

Business Made to Improve

Encouragement is found in the keynote paragraph of the First Wisconsin's review, which says: "The events of the last 30 days have yielded much justification for confidence. Business improvement cannot be expected unless somebody does something to make it improve. A good deal of appreciation is now being displayed. Just as depression resulting from sharply falling prices last year spread from some lines of business to others, so renewed activity in cotton and woolen goods, motor vehicles and new construction applies a stimulus to set other lines of trade going again.

"Prospects are brighter than they have been for many months. But much remains to be done before this depression will become a memory. The sticking points that will still have to be overcome are: The readjustment of labor costs in conformity with the movement of prices; the reconcilement of prices with one another; some having gone too low and others not low enough; and perhaps most important of all, the devising of means whereby we can use our superior credit position as a basis of selling goods to foreign countries."

Los Angeles in Turmoil

LOS ANGELES, May 24—Dealers here refuse to commit themselves to an opinion upon the effect of announcements of price reductions upon the automobile sales conditions. One point upon which all agree and none is reluctant about expressing an opinion is that the used car business is again in a state of turmoil. One dealer is reported to have said the price reductions announced within the past two weeks have cost him $10,000 in shrinkage on used car values. It is too early now to hazard a prediction as to the stimulus that will result in increased sales of those cars prices of which have been reduced.

The Al G. Faulkner Co., California distributor of the Marmon, has been placed in the hands of a receiver upon petition of the Nordyke & Marmon Co., which is said to have claims against the dealer amounting to $150,000. The Faulkner company has been operating on a large scale throughout the State. Two large establishments have been maintained here and another in San Francisco.

Cleveland Acts to Stop Ohio Truck Weight Bill

CLEVELAND, May 23—The Cleveland automobile industry has never been aroused over a matter as it has been with respect to the Burke bill, which limits the weight of truck loads. The measure has been passed by the general assembly and it is now awaiting the signature of the Governor before it becomes a law.

One hundred representatives of the city's automotive and commercial interests at a meeting in the Hotel Winton unanimously voted to send a delegation to Columbus to protest against the bill, which was pronounced an "economic disaster" should it become a law, not only to Ohio's truck and tire industries, but also to every consumer who benefits from transportation provided by trucks.

SPROUL SIGNS FUEL TAX BIIL

HARRISBURG, PA., May 23—Governor Sproul to-day signed the "cent-a-gallon" gasoline tax.

This law affects every sale of gasoline to a consumer in Pennsylvania. More than $2,000,000 a year will be realized in revenue by the measure's operation.

The tax becomes effective on Sept. 1. It is estimated that Philadelphia, for instance, will receive $350,000 a year.

Reduced Cars Hold Sales Leadership

Wholesale Business Advances in New York Territory—Truck Sales Grow

NEW YORK, May 21—The passenger cars whose prices have been reduced within the past three weeks are still selling strongly in the New York territory. In most cases retail sales have not been as strong as they were during the first week, but the volume of business, as compared with what it was before the reductions, is satisfactory to the distributors and branch houses concerned. In the wholesale, the past week's volume of business has been considerably better than the first week of the reduced prices, indicating that out-of-town dealers have not been able to take their story to the public quite as quickly as metropolitan merchants.

In the case of two or three cars whose prices were reduced during the present week, the response of the buying public was practically instantaneous and there is a more general feeling among New York distributors than there was a few months ago that the price question is of paramount importance in the view of the public.

In lines which have not cut, or if they have cut did so months ago, there is marked stagnation. One or two of the most popular lines in this class have come somewhere near resuming their old stride after two weeks of slow sales immediately following the most sensational of the price cuts. However, even these lines are having to batter down strong sales resistance based on the price question. Some other lines which hitherto have been selling well have been practically standing still since May 1. Generally speaking, business outside of that enjoyed by dealers in cars recently reduced in price cannot be said to be good.

Truck sales are showing a slightly upward trend. Sales are particularly good in two or three classes of low and medium priced light weight trucks.

The heavier trucks are beginning to feel the competition of offerings here of American and foreign trucks brought in from former war areas of Europe, and priced at low figures. When these trucks first appeared in the open market, buyers were suspicious of their condition and sales were not numerous. Within the past two or three weeks, however, there have been enough of these sales to cut in a considerable degree the revenues of dealers and branch houses handling several prominent lines.

Accessory sales continue to run along on something like 60 per cent of last year's volume.

TRUCK MERGER EFFECTIVE

KENOSHA, WIS., May 20—The merger of the Winther Motor Truck Co., the Marwin Motor Truck Co. and the Kenosha Wheel & Axle Co. became effective to-day.

Crop Outlook Helps Business in South

May Leads April in Sales and Prospects Are Numerous—Credit Steady

NEW ORLEANS, May 23—The period of readjustment in the automotive industry in the territory supplied by the dealers and distributors of this city seems to be nearing an end. May sales, up to the 20th of the month, were greater for virtually every dealer in New Orleans than they were for the first three weeks of April, while prospects were reported as more numerous than they had been since June, 1920.

This steady improvement in automobile sales is considered by the dealers to be due, to a great extent, to the recently-devised co-operative sales plans for the cotton crop, and the revival of the War Finance Board, with accompanying aid from it in disposing of the South's cotton in Europe. Two other considerable factors are the temporary tariff on sugar, the effects of which already are being felt in an increased optimism among the sugar planters and their workmen, and the development of a better class of automobile salesmen.

Payments are much steadier and more regular, and collections considerably easier than they have been since last year. Improvement in this regard also is shown in the country, where conditions generally have been much slower to readjust themselves than in the cities. Improvement in collections has been so great that virtually all the New Orleans dealers are taking their cars promptly out of the railroad warehouses, meeting their notes as they fall due, and discounting some of their paper in advance.

All this has put the dealers on a more independent footing, and has considerable influence with the banks, for some of the short-sighted bankers, it must be said, were expressing themselves widely and freely as to the doubtful future of the automotive industry. All of these doubters have been discredited and cast out by the gain in this industry in the past 60 days in all the Southern states.

One of the greatest aids in this development, especially among the Louisiana dealers, has been the steady, consistent and encouraging work of the New Orleans Automobile Dealers' Association.

TEXAS ROADS TO OPEN STATE

FORT WORTH, May 20—With the spring time and the new automobile season has come the greatest road-building boom in the history of North and West Texas. Pikes costing $50,000,000 are under construction from the four corners of the state. And on top of this huge sum, bond elections will be held in many farming and ranching communities this month to authorize more funds.

Each new bond issue voted and each new highway contract awarded means sections hitherto inaccessible to the machines will be opened up.

STUDEBAKER BUSINESS NEAR YEAR'S TOTAL

NEW YORK, May 20—A summary of sales of Studebaker cars in the Greater New York district to April 30 shows 1029 sold to this time, only ten less than for the whole year of 1920. Sales in April were 386 cars, as compared to 149 in April, 1920. The 1029 cars sold in the first four months of this year represent an increase of 529 over sales for the first four months of 1920.

Toledo Plants Active As Business Revives

TOLEDO, May 23—There are 1200 workers now on the payroll at the plant of the Electric Auto-Lite Corp., one of the subsidiaries of the Willys Corp., according to C. O. Miniger, president. Two weeks ago the force numbered only 800. The farm lighting business as well as the automobile lighting plant orders are picking up, he reports.

Nearly 200 men are now being employed at the Toledo Chevrolet plant where transmissions are assembled. A few at a time are being called back to work.

Daily additions to working forces are also being made at other automotive equipment plants here. The Mather Spring Co., the Bunting Brass & Bronze Co., the Milburn Wagon Co., and the Champion Spark Plug Co., all report increased business in the last two weeks.

Premier Starts Suit for Skelton Insurance

INDIANAPOLIS, May 21—Payment of a $200,000 insurance policy on the life of L. Sherman Skelton, former president of the Premier Motor Corp., is being fought by the Travelers Insurance Co. on the ground that Skelton misrepresented the condition of his health when he took out the policy. A cross complaint was filed by the insurance company in answer to a suit brought against it by the Premier Motor Corp. and other administrators of the Skelton estate, who sought payment on the policy under which the Premier company was the beneficiary. The policy was assigned by the motor car company to the Fletcher American National Bank of this city.

CONFER ON BRAKE LININGS

WASHINGTON, May 20 — Recommendations for a standard method of testing brake lining materials for automotive purposes, made following a recent conference at the Bureau of Standards, were discussed last week by engineers of the bureau with representatives of nearly all the manufacturers of this class of material, as well as of the Motor Transport Corps and the standards committee of the Society of Automotive Engineers.

Continued High Sale Looked for in June

Central Ohio Territory Finds Weather Big Aid—Truck Business Increases

COLUMBUS, May 23—With the arrival of better weather conditions, there is a noticeable increase in the demand for automobiles in Columbus and central Ohio territory. This is the report of a large number of retailers in the passenger line of vehicles and it is believed by them that conditions will continue to improve from this time on. At least preparations have been made for a good demand for passenger cars during the month of June and possibly for a portion of July.

Dealers in passenger cars report a growing demand for closed jobs. The closed body is now the popular thing and there is a growing scarcity of such cars in central Ohio territory. Touring cars are still selling well and the open runabout is also in good demand.

In the farming sections a gradual increase in the demand for cars is reported and dealers in the strictly rural sections are becoming quite busy again.

Truck sales are now increasing appreciably. For a time there was a lull in the demand for trucks, but now commercial houses are doing considerable shopping around. The strongest feature of the commercial vehicle market is for the one, the one and a half and the two-ton trucks. The heavier trucks are not selling as well as the lighter varieties. The light delivery wagon is moving fairly well under the circumstances.

There is also a sort of spurt in the repair business in Columbus. All of the service stations and many of the repair shops report a good run of business. The overhauling of passenger cars is going on rapidly and most of the larger shops are pretty well crowded with work. Parts departments are doing a good business and many replacements are being made.

GASOLINE STOCKS INCREASE

WASHINGTON, May 20—Increased use of automobiles is reflected in the refinery statistics of the Bureau of Mines, showing that the daily average consumption of gasoline for March was 2,600,000 gal. larger than that of February, and 2,900,000 gal. than in March, 1920. The daily average production of gasoline for March was 322 gal. less than the production for February, though it exceeded the production for the same month last year by 165,000 gal. Stocks of gasoline increased during March to 713,043,480 gal., the largest stock of gasoline on record.

The daily average production of lubricating oils was 2,354,945 gal. during March, a decrease of 232,000 gal. Total stocks of lubricating oil on hand at the refineries March 31 amounted to 223,414,093 gal. as against 130,632,597 gal. for March, 1920.

Dayton Entertains Engineer Delegates

McCook Field Inspection Followed by Instructive Talks on Aircraft Studies

DAYTON, OHIO, May 21—Several of the S.A.E. members en route for the West Baden convention, and members of the A.S.M.E. bound for their Chicago meeting, were entertained here to-day by the Dayton Section of the S.A.E., McCook Field and the Dayton Engineers' Club.

Given as a joint meeting of the A.S.M.E. and S.A.E., those who attended were afforded an unusually complete exhibition of all types of aircraft both on the ground and on the wing. During the entire morning McCook Field was thrown open to the engineers, who were taken on a complete tour of inspection through practically all the departments.

After luncheon at the field a technical session was held at which military and civilian members of the McCook field staff presented a series of papers covering phases of airplane engineering. The evening was given over to a dinner at the Engineers' Club where C. F. Kettering, Joseph Steinmetz, head of the aircraft section of the mechanical engineers and V. E. C. Handley Page, were the speakers.

Twenty planes of all descriptions were lined up on the field, eight of them taking the air. Among those flying were the Junker all-metal plane, the big 1200 h.p. Caproni, and the 60 h.p. Messenger, which, with its three-cylinder engine, afforded an interesting contrast with the roaring giants equipped with two and three Liberty engines.

Members of both societies exhibited greatest interest in the radio-controlled wagon which was started, stopped and steered to left and right by wireless. The wagon is a torpedo-shaped box and its manipulation from a distant station made its movements seem almost uncanny as it would run up to a group of visitors, stop, blow a horn, ring a bell and then whirl about and start off in another direction.

Technical Session Interesting

The technical session proved to be one of the most interesting aeronautical meetings the S.A.E. has held. Papers were presented on aluminum air-cooled cylinders, by E. H. Dix, Jr.; radio-telegraphy and telephony by O. E. Marvel; carbureter design, C. F. Taylor; radiators, Lieut. Bayard Johnson; camouflage, C. R. Young; air-cooled engines, S. D. Herron; air photography, Lieut. E. E. Aldrin, and synchronization of propeller and machine gun fire by H. O. Russell.

Through these varied papers the engineers present were given a rapid panorama of late developments in the field of airplane activity. Speaking of the attempts to cast an aluminum air-cooled head on a steel cylinder, Dix stated that experiments had gone far enough to show that the idea is feasible. In effecting a juncture between the steel and aluminum various coatings were used. Tinning and sherardizing were best with advantage in favor of the latter because the melting point of zinc is higher. Micro-photographs of steel cylinders with the aluminum head show that there is a good juncture between the two metals. After various experiments for materials to be used as valve seat inserts and spark plug bushings, low phosphor-bronze has been found best because of the nearness of its coefficient of expansion to that of aluminum.

Discuss Aluminum Alloys

In making the castings elaborate care must be taken to prevent cracking. The cores in the later castings are being preheated to 500 deg. Fahr. before pouring and then the entire mold is placed in a core oven and kept at 500 deg. Fahr. for an extensive length of time. The best aluminum alloy for the purpose so far has been aluminum-silicon. Its strength falls off 2½ per cent at 300 deg. Fahr. and 20 per cent at 500 deg. Fahr. It is satisfactory within the limits of working temperature in the engine. It is also good on porosity test. The Bureau of Standards is at present obtaining data on other physical characteristics. The alloy has about 7 per cent silicon.

In discussing air-cooled engines generally Mr. Herron stated that it is now possible to show just as good m.e.p. and output figures as with water cooled, without the disadvantage of freezing in a nose-dive. To date, 12 cylinder engines up to 240 h.p. have been built and give satisfaction. Brake m.e.p.'s of 130 lb. per sq. in. have been attained and the cylinders have been built up to 8 by 10.

Lieut. Johnson in discussing airplane radiators pointed to the depth of core possible because of high air velocity. He stated this to be the leading difference between airplane and automobile radiators. For the Liberty engine it is necessary to pump 73 gal. of water per min. through the jackets to meet the required minimum of 18 deg. heat range. For this reason there must be no restriction of flow.

The method of testing radiators is to climb the machine at its maximum rate and then take readings at every 1000 ft. The results are plotted curves of mean water temperature and air temperatures being drawn.

Plea for Cheaper Planes

At the dinner both Messrs. Handley Page and Kettering made a plea for lower-priced planes and engines. Kettering said that the first step in securing "commercial aviation" would be to develop a 150 h.p. engine to sell at $750. The reason there is no commercial aviation to-day is because there are no planes which can be built economically. To put it in his own inimitable way, "There are too many gim-cracks—There is not enough intelligent ignorance among aircraft engineers—There are too many reports on matters which 'can't be done'."

Non-Combatants Offer Strong Car Markets

Studies by Secretary Hoover Show Stabilized Exchange Helpful Factor

WASHINGTON, May 26—Study of markets for American automobiles in the Netherlands, Norway, Poland, Spain, Sweden and Switzerland as conducted by the Commercial Attachés of the Department of Commerce shows that American exporters have a wide field which could be easily cultivated to their advantage. Results of the survey are made known in the second of a series of reports on the European industry and trade. Most of the countries which maintained neutrality during the recent hostilities show evidence of stability in exchange, an important factor in the development of American foreign trade.

Holland is less affected by the depressing conditions in the European market for the sale of motor cars than any other country on the continent except, perhaps, Spain. Official reports indicate that money is available and that the American producers control the market to a greater extent than other nations, although the French cars manufactured have a good standing in this country. With the exception of the Spyker plant, which produces about 100 cars per month on the 1921 schedule, there is relatively little domestic production of cars. The Spyker is a six cylinder car selling for approximately 20,000 florins.

There are 27 American agencies listed in Holland, as compared with 26 French, 24 English, 19 German, 7 Italians, 3 Dutch, 3 Belgium and 1 Swiss. The simplicity of the American design and the interchangeability of parts with the quick supplying of spare parts are advantages that the European makers do not afford their customers. In the opinion of C. S. Johnston, Commercial Attaché at The Hague, the matter of service is very important and should be developed because the best sellers are those combining the lowest first cost and economical maintenance and operation. He believes that Europe has long been acquainted with the small-bore high-speed motor which has demonstrated to the satisfaction of the buyer that it is not an extravagant fuel user and is the most economical car to own.

Waterways Handicap Trucks

The waterways of Holland have a natural tendency to prevent the development of a large truck business. It is reported that American truck producers who have investigated the situation feel that it will not be worth while to force the market with anything over a 1½-ton truck. The narrow streets and roadways make it impracticable to operate heavy trucks. The emigration to America has stripped many of the farms of their labor supply and, as a consequence, has directed interest to farm machinery.

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Tractors and Horses to Meet in Contests

N. I. V. A. Arranges Series of Meetings to Demonstrate Mechanical Economy

CHICAGO, May 23—The National Show and Demonstration Committee of the N. I. V. A. has decided to hold a series of contests between horses and tractors in field operations. There will be three demonstrations, the first of which is scheduled for Fargo, N. D., June 28, 29 and 30. Another demonstration will be held in the Southwest and the third in the Central West, time and location of each to be decided later.

Two shows also have been authorized; one for Minneapolis and the other for Kansas City, provided suitable quarters can be furnished rent free, and provided also that all other suitable and satisfactory arrangements can be made between the local and national committees.

The horse and tractor contest is of special interest and in order that the results of these comparative tests may be unbiased, fair and convincing, the committee resolved that:

"The observations and data for such records be taken by a committee composed of representatives from the American Society of Agricultural Engineers, from the State University either of the State where the demonstration is held or the university of any other State; from tractor manufacturers, from the Society of Automotive Engineers, from the Horse Assn. of America and from the United States Department of Agriculture."

As an inducement to secure the very best horsepower available, it was decided to award suitable prizes to horse owners entering the contest and making the best records on the cost of preparing their land allotments.

The dollars and cents cost comparison between horse power and tractor power in plowing and preparing seed bed as provided in these demonstrations will not take into account some of the most vital considerations in successful tractor operation, especially belt work, but new rules are provided by the committee so that manufacturers of belts and belt driven machinery of any kind, operated with a tractor, are eligible to exhibit at these demonstrations. It is expected that the educational work of belt operations will be among the most interesting features of the demonstrations.

No individual records of tractor performance and no comparisons between individual tractors will be given out for publication by the committee in charge of the demonstration. Each tractor manufacturer, however, will be provided with the record of his own machines.

JANESVILLE BUYS TRAILERS

JANESVILLE, WIS., May 23—The Janesville (Wis.) common council has placed a contract with the Highway Trailer Co. of Edgerton, Wis., for four 2½-ton trailers with dump bodies and hoists as initial equipment of a new municipal garbage collection system. The trailer is a special design known as the Highway Garbage and Ash Trailer, which is now being manufactured in quantities for municipalities. The cost of the four trailers is $7,280, less 25 per cent, f.o.b. Janesville, or net $5,460.

Delaware Law Requires Ownership Certificate

WILMINGTON, DEL., May 23—Under a law passed at the last session of the Delaware Legislature, which becomes effective June 1, a sworn certificate of ownership, with minute details of the car, must accompany every application for a motor license in the State. New forms, in compliance, with this law, have been issued by Secretary of State Alden R. Benson. They require the name of the owner of the car, with his business and home address, also a complete description of the vehicle, under oath taken before a notary.

There is also space on the form for the name and address of the vender from whom the car was obtained. All of this information must be sent to the office of the Secretary of State, in Dover, where it is kept on file. The penalty for making a false statement is a fine varying from $500 to $5000, or imprisonment from six days to five years.

The effect of this law, it is understood, is that every sale of a motor vehicle shall be known to public officers, and it will be kept on file.

After Sept. 1 it will be unlawful to have in one's possession a motor vehicle for which a certificate of title has not been issued.

BAR ACCESSORY INSURANCE

ATLANTA, May 21—The Southern Underwriters' Conference has decided to write no more insurance against the theft of automobile accessories. This action has been taken because of heavy losses on the theft of such equipment as spotlights, motormeters and spare tires. These losses have been general throughout the South. The Southern Underwriters' Conference comprises the States of Virginia, North and South Carolina, Georgia, Florida, Alabama, Louisiana and Arkansas. Practically every insurance company in these states is a member. Insurance now in effect will not be cancelled until it expires.

WISCONSIN ADDS NEW MODEL

MILWAUKEE, May 23—The Wisconsin Truck Co. of Loganville, Wis., engaged for three years in manufacturing motor trucks for general farm and light commercial trucking, has added to its line a larger model produced for several years by the Luverne Motor Truck Co. of Luverne, Minn., with which the Wisconsin company is closely affiliated financially. The larger model is equipped with a six-cylinder Continental motor and has a capacity of three tons.

Inspection to Lower Insurance Losses

Wisconsin Agencies Make Careful Survey of Risks to Prevent Imposition

MILWAUKEE, May 23—In several cities in this section automobile insurance agencies are inaugurating an inspection service as a device to lower the losses of insurance companies, especially on theft and collision coverages. As is becoming known, some companies are declining to write full collision policies. Others are now beginning to limit their liability on theft coverage.

The inspection service being installed varies with different insurance agencies. A typical one operates as follows:

When a car is written for fire, theft or collision, an inspector is sent to see the car and report on it in detail as to condition, number and age of tires, approximate usage, date of purchases, etc. A copy of the report is filed with the assured. If a used automobile is insured, inspection is followed up at least every six months.

The insurance men state that frequently when the owner of an automobile receives the report, insurance is cancelled. An underwriter here said:

"We claim that the insurance companies are imposed upon, especially in cases of reported thefts of tires. The claims always seem to be for brand-new tires. When a claim comes in, under the inspection system, we can refer to our records. Defects of tires are noted at the time of inspection. Radiators are examined. It is a fact that the greatest savings we have made come from cancellations of policies by the insured when they find out that we have a complete report in every detail of the car, tires and all. Losses have been a heavy drain on the companies, and it is necessary to reduce losses or make the rates practically prohibitive."

S.A.E. Discusses Means to Check Theft of Cars

NEW YORK, May 20—The subject of automobile theft prevention was discussed from several angles at the Metropolitan Section meeting of the Society of Automotive Engineers May 19. The opinion was voiced by some that the insurance companies by granting insurance to the full value of the car tended to encourage carelessness on the part of the owner. The advisability of granting insurance for only 75 per cent of the value was discussed.

The car owner is chiefly responsible for most thefts, according to several of the speakers, because of his failure to use the lock and safety devices even when his car is equipped with them. There was also some sentiment expressed indicating that the manufacturers of locks did not always provide enough key changes on their product.

Production in 1919 Dwarfs 1914 Figure

Industry Grows Almost Five Times in Five Years—Michigan Far in Lead

WASHINGTON, May 21—Official statistics compiled by the Bureau of Census reveal the tremendous growth and importance of the automobile industry. Production figures received from 315 establishments in 1919 show that the total output amounted to $2,387,834,000. In 1914, 300 establishments reported manufactures valued at $503,230,000. About 56 per cent of the automobile industry is located in Michigan, as the output of 68 establishments in that state amounted to $1,332,076,000. There were 1,683,938 automobiles produced in 1919, with a valuation of $1,555,129,000, as against 573,039 in 1914 valued at $465,058,000, an increase of nearly three times.

The government figures, which are preliminary and subject to final revision, show that 101,837 trucks valued at $193,351,000 were produced in 1919, as compared with 19,519 trucks and a value of $34,741,000 in 1914. Delivery wagon production totaled 18,122, valued at $16,570,000. In 1914 the production of this type of vehicle aggregated 4391, with a value of $12,750,000. All other types of business vehicles not specified amounted to 955 machines in 1919, valued at $2,283,000, as compared with 262 machines in 1914 with a value of $787,000. In the aggregate there were 120,914 business vehicles manufactured in 1919, with a value of $212,204,000. In 1914 there were 24,172 vehicles valued at $40,278,000.

The total valuation of $2,387,834,000 as given by the Census Bureau did not include, for 1919, 5012 automobiles and 80 trailers to the value of $8,067,562, and in 1914 4258 automobiles valued at $6,296,558, which were reported by establishments engaged primarily in other industries.

Parts Gain Enormous

Comparison of chassis production is impossible because it was not reported separately in 1914, but the 1919 figures showed 192,418, which were produced at a valuation of $181,889,000. The same condition obtained with trailers, which were not reported in 1914. In 1919, 15,606 trailers were manufactured with a value of $6,534,000. The total valuation of bodies and parts for 1919 was $533,068,000.

Segregating passenger vehicles it is found that 1,552,349 machines valued at $1,318,038,000 were manufactured in 1919. Production figures of 1914 showed 543,438 vehicles, valued at $413,696,000. No record was kept of production of roadsters in 1914, but in 1919, 51,360 roadsters were produced, valued at $58,033,000. The total production of touring cars in 1919 amounted to 1,224,347, with a value of $977,411,000. In 1914 the 451,032 touring cars were valued at $345,973,000. Closed cars turned out in 1919 aggregated 156,328, valued at $200,015,000. During 1919 only 10,809 closed cars were produced with a valuation of $21,833,000. All other passenger vehicles manufactured in 1919 amounted to 1216 with a value of $2,056,000.

Public Vehicles Doubled

Classified as public conveyances and known as cabs, omnibuses, etc., the census figures showed 877 machines valued at $3,101,000, were produced in 1919 and 443 machines valued at $846,000 in 1914. Of a total production of 2786 machines valued at $13,619,000 for 1919, there were 391 ambulances valued at $613,000 produced. In the same year there were 759 motorized pieces of fire apparatus manufactured valued at $6,939,000. All other machines manufactured for Government and municipal service such as mail delivery, tanks, patrol wagons, street sweepers and oilers, amounted to 1636 machines in 1919, having a valuation of $6,067,000, as compared with 17 machines and a valuation of $45,000 in 1914.

It is interesting to note that this enormous production of gasoline propelled machines far outstripped electric and steam driven automobiles. Comparison of production statistics shows that fewer electrics and steamers were produced in 1919 than in 1914. In 1919 there were 3034 electrics and 406 steam propelled machines manufactured, as against 4669 electrics and 401 steam automobiles in 1914. The total valuation mentioned for bodies and parts did not include production by establishments engaged primarily in other industries.

Comparative Automobile Statistics, 1919 and 1914

Type	Number 1919	Number 1914	Value 1919	Value 1914
Total (1)			$2,387,834,000	$503,230,000
Passenger vehicles	1,553,349	543,438	1,318,038,000	413,696,000
Roadsters	51,360	(2)	58,033,000	(2)
Runabouts	120,098	81,597	80,523,000	45,890,000
Touring cars	1,224,347	451,032	977,411,000	345,973,000
Closed cars	156,328	10,809	200,015,000	21,833,000
Other cars	1,216	(2)	2,056,000	(2)
Public conveyances:				
Cabs, omnibuses, etc.	1,877	443	3,101,000	846,000
Government, municipal, etc.	2,786	728	13,619,000	3,941,000
Ambulances	391	49	613,000	139,000
Fire department apparatus	759	662	6,939,000	3,757,000
All other (mail delivery, tanks, patrol wagons, street sweepers, oilers, etc.)	1,636	17	6,067,000	45,000
Business vehicles	120,914	24,172	212,204,000	40,278,000
Delivery wagons	18,122	4,391	16,570,000	4,750,000
Trucks	101,837	19,519	193,351,000	34,741,000
All other	955	262	2,283,000	787,000
Chassis	192,418	(2)	181,889,000	(2)
Trailers	15,606	(2)	6,534,000	(2)
Bodies and parts	.....	.....	533,068,000	(2)
All other products	.....	.....	119,381,000	44,469,000

(1) In addition, in 1919, 5,012 automobiles and 80 trailers to the value of $8,067,562, and in 1914, 4,258 automobiles valued at $6,296,558, were reported by establishments engaged primarily in other industries.
(2) Not reported separately in 1914.

BUY TRUCKS FOR CATTLE CARS

WASHINGTON, May 20—By order of the Minister of Agriculture, two motor trucks of the type used during the war were recently purchased from France for hauling cattle for the use of the Brazilian Agriculture College. The bodies of the trucks are covered and closed, each having a capacity for four full grown cows.

To Speed Compilation of Export Statistics

WASHINGTON, May 23—More prompt service by the Bureau of Foreign and Domestic Commerce in publishing statistics of the nation's foreign trade will result in announcements of the detailed figures from two to four weeks earlier than before.

The figures, according to the announcement of the Bureau, will be published in two parts, the first of which will be given out on or about the 23rd of the succeeding month. This part will contain "the figures most urgently needed by the trade and will include imports of merchandise by articles and principal countries and exports of domestic merchandise by articles and principal countries, followed by an index of articles and statements of total imports and exports."

Preliminary statements summarizing imports and exports will be given out within 10 or 12 days after the close of month. This will be from 10 days to two weeks earlier than has been the rule.

The service will be speeded up without additional cost to the Government, the statement sets forth, as a result of some changes in the compilation methods. The Bureau co-operates in this work with the Treasury Department which furnishes the original data.

Austin Creditors Agree to Business Continuance

By Cable to AUTOMOTIVE INDUSTRIES

LONDON, May 21—Creditors of the Austin Motor Co., after a full discussion of its financial position, agreed unanimously that the business should be continued so that a plan can be formulated to put the company on its feet. For this reason they have asked that hearings be indefinitely postponed on the petition for compulsory winding up of Austin's affairs.

Dealers Enter Protest Against Excise Taxes

(*Continued from page* 1127)

upon automobiles is a tax upon modern incomes. Seventy-five per cent of all the cars and trucks outside the Atlantic States are in 37 states which have but 45 per cent of the National wealth."

Because Congress has evinced a desire to protect the farmer, the dealers' organizations mentioned that a tax on motor vehicles "is as much a tax on farm production as would be a tax on threshers, plows, tractors, or farm implements. This burden is felt directly by the farmer in the purchase of motor trucks, and is felt acutely by the farmer when he is forced to pay a 5 per cent tax upon his repair parts."

In recommending the repeal of the excess-profits tax, it was declared that "this form of taxation is a deterrent to the initiative enterprise because in productive years it is nearly impossible to set aside sufficient reserves that all enduring business must have to tide them through periods of financial stress such as we are now experiencing." It was further asserted that in times of rising prices the excess-profits tax leads to the "loading" of prices and extravagance in business management, and at best is always an uncertain factor in price making.

In suggesting a reduction in the higher brackets of the income surtax, the dealers expressed the belief that it would induce capital now in exempt securities to return to industry. It was said, "this return would likewise restore the purchasing and investment power to the individuals thus employed who in turn would be a considerable prospect for the absorption of the tax-exempt sucurities so abandoned."

Should Not Set Standards

Discussing the question of essentiality, the dealers declared: "We do not believe that it is a function of free government to set up standards, arbitrarily, of essential or non-essential industry, nor classification of necessities or luxuries. We believe that in a government such as ours, the government should guarantee to all business perfect freedom of existence, expansion of opportunity, and should permit each individual to make the choice as to what is essential to his own welfare and happiness. What are luxuries for some are necessities for others and we do not believe that it is a legitimate function of government to bestow official sanction upon some and impose official condemnation upon others."

Harper stated that the automobile dealers favor the sales tax provided that it is extended to all commodities. He explained that dealers were convinced that a sales tax would be an ethical and equitable form of taxation for all and would produce the desired and needed revenue.

The N. A. D. A. stressed the necessity for economy in governmental expenditures in order to reduce tax rates. It was suggested that the war debt should be distributed over several generations. They recommended the refunding of the present war debt in such a manner that it will be amortized in installments over a period of 50 years. They declared themselves in favor of a moderate protective tariff.

To illustrate the tremendous amount of money paid in taxes on automobiles other than Federal taxation, the Association pointed out that the only state money that is at all available to match Federal aid funds in highway construction and maintenance is derived from motor or vehicle registration fees.

KANSAS CITY RESERVE TO ACCEPT CAR PAPER

KANSAS CITY, May 25—Governor Miller of the Kansas City Federal Reserve Bank announced after a conference to-day with representatives of the automotive industry that he was willing to have automobile paper accepted as collateral at the Federal Reserve Bank. A general statement on the subject will be made public through the press of the district. This follows the visit to Kansas City by Governor Harding of the Federal Reserve Board and is expected to exert a strong stimulating influence on the industry in this section of the country.

Federal Reserve Head to Address N. A. C. C.

NEW YORK, May 23—The annual meeting of the National Automobile Chamber of Commerce, to be held Thursday, June 2, will be addressed by W. P. G. Harding, governor of the Federal Reserve Board. There has been so much misunderstanding relative to the position of the Federal Reserve in connection with loans to certain industries that Governor Harding is desirous of telling all the facts as they relate to the general credit and business situation.

Another interesting feature of the annual session will be a debate at the truck manufacturers' meeting on the subject, "Which Best Serves the Motor Vehicle Users—A Parts Service Rendered by Dealers or a Parts Service Rendered by Parts Manufacturers?"

SHARON RESUMES STEEL WORK

SHARON, PA., May 21—Announcement is made by Harry W. Torney, recently made president of the reorganized Sharon Pressed Steel Co., that its financial difficulties have been satisfactorily adjusted and that it now is in position to handle production of frames up to 1500 a day. Production is now in charge of Arthur W. Swan, general manager, who formerly was chief engineer and works manager of the Crucible Steel Co.

Harding Says Banks Now Have Ample Funds

(*Continued from page* 1126)

governor of the Federal Reserve Bank of the tenth district.

Governor Miller's speech was short and very much to the point. He said:

"The tenth district was not exempt from the national joy ride beginning in October, 1919. It was called upon to distribute credit equal to its entire lending power. By April, 1920, it had rediscounted and borrowed $10,000,000, which sum will be later increased $35,000,000 from other districts. Lending by this bank had to stop, that our credit be conserved. It was necessary to scrutinize all paper for rediscount. Every class was scrutinized. It is true that in accordance with our responsibility to the general agricultural situation we felt that we should accept the most essential paper.

"The impression prevailed that the Federal Reserve Bank had declared automobile paper not essential. We never suggested to a member bank that it should not freely lend to dealers. We did say to banks, 'You have ample loans on agriculture and live stock to take up your limits. We prefer you send us that and keep the other in your portfolio.' Twelve to fifteen per cent of a bank's portfolio is the usual proportion for rediscount with the Federal Reserve Bank. There is ample room in each bank's portfolio for all the automobile paper it might wish to take. The year 1920 was a hard one with the reserve close to the irreducible minimum. We had a liability to those member banks which had not used our facilities, of $60,000,000. Our responsibility to the district was for the best good of all, including yourselves. If we had not acted in the way we did act, you wouldn't be selling cars now, but the corner seems to have been turned. We can see it more clearly to-day than thirty days ago. If nothing extraordinary happens in the next week or so we can congratulate ourselves that we are fast getting back to normal, and there will be no further scrutiny of paper other than for solvency and desirability."

Two Points Singled Out

This statement was greeted with applause and cheers. Governor Harding, following, urged two points upon the automotive industry interesting in view of prospective relaxation in attitude of member and Federal Reserve Banks toward motor paper. The Governor urged that dealers observe punctiliously the forms prescribed for preparation of paper, and forget their objections to those requirements which many have considered annoying. He also urged that, in the coming period of larger business, care be taken to build substantially, aiming to give real service and not anticipating a boom with extraordinary profits. Governor Harding declared that dealers would congratulate and be thankful to Governor Miller for the masterly manner in which the Kansas City Federal Reserve Bank was handled.

Durant Controls Sheridan Motors

Youngest Line Sold by General Motors

Burke President Under Changed Ownership—Main Durant Plant at Lansing

NEW YORK, May 25—Developments came rapidly to-day in the affairs of Durant Motors, Inc. The two most important were:

That Durant has acquired a controlling interest in the Sheridan Motor Car division of the General Motors Corp.

That the main Durant factory will be located in Lansing and will be under the direction of Edward Ver Linden.

The first formal statement in reference to Sheridan came from the headquarters of General Motors. It said:

"Arrangements have been made by the General Motors Corp. whereby D. A. Burke will purchase the Sheridan Motor Car division and continue it as a separate line."

This announcement brought from the Durant offices the statement that Durant Motors, Inc., had acquired the controlling interest in the Sheridan Motor Car division and that it would be conducted by a $3,000,000 corporation which probably would be known as the Sheridan Motor Car Co. Production will be continued in the factory at Muncie of a car which will be virtually identical with the Sheridan now being made for the General Motors Corp. It is understood that the consideration was in the neighborhood of $5,000,000.

Burke, who spent many months in developing the car, will continue at the head of the company, under the new ownership. He formerly was Buick distributer in Chicago and sold Durant on the idea of turning out at a moderate price a car embodying most of the refinements usually found in higher priced models.

Factory Now Operating

Production began only a few months ago and much attention has been paid of late to building up a dealer organization. One of the prominent distributers selected was Eddie Rickenbacker, famed as an aviator.

This statement was made in reference to the main Durant plant:

"Durant Motors of Michigan, with a capital of $5,000,000, will have its main plant at Lansing, Mich., with a capacity of 40,000 cars a year. E. Ver Linden, who has been responsible for the building up of the Olds Motor Works, will be president and general manager. The plant will assemble and distribute Durant cars between the Adirondacks and the Rocky Mountains under contract and control of Durant Motors, Inc."

Announcement that Ver Linden had joined the Durant organization was made in AUTOMOTIVE INDUSTRIES last week. The ground already has been broken for the Lansing plant and it is expected to be ready for occupancy by Nov. 1.

The report is not denied that T. W. Warner, head of the Muncie Products division of General Motors, soon will relinquish his position to join forces with Durant. His retirement is not expected to involve any change in the present ownership of Muncie Products. The plant of the T. W. Warner company at Muncie, Ind., was acquired under lease by General Motors during 1919, with option to purchase after Jan. 1, 1923. Warner also heads the Toledo-Chevrolet Co., which manufactures transmissions.

Klingensmith Mentioned

F. L. Klingensmith, former general manager for Henry Ford, who now heads the Gray Motor Co., declines to deny reports that he will be associated with Durant with the Gray company as a unit of the Durant organization. He asserts, however, that his company will be in the market at the end of the year with its own car.

R. H. Collins, former president of the Cadillac company, now is spending all his time in the main building of the old Cadillac plant which was purchased from the General Motors Corp. for the Collins Motor Car Co., now being organized. The portion of the former Cadillac plant purchased by Collins contains more than 300,000 sq. ft. of floor space.

There is reason to believe that when production actually is begun by Collins and Ver Linden, they will add to their organizations several of the men who served under them in executive capacities at the Cadillac and Olds divisions of General Motors. It also is understood that Durant already has opened negotiations with some of the most successful distributers of the General Motors Corp.

NASH DECLINES STATEMENT

KENOSHA, WIS., May 23—Charles W. Nash refused to-day either to confirm or deny persistent reports that the Nash Motors Co. would acquire a substantial interest in Lafayette Motors Co. of Indianapolis. Nash himself is president of Lafayette Motors and has a large personal interest in that company.

Distributorships Combined

INDIANAPOLIS, May 24—New distributers in Chicago and Philadelphia were named this week by E. C. Howard, vice-president of Lafayette Motors Co.

Chicago-Nash Co., under the direction of H. T. Hollingshead, will handle the Lafayette in Chicago. A Nash association has also been made in Philadelphia.

Reimported Trucks Throttling Trade

New York Dealers Unable to Meet Prices on Ex-Army Vehicles

NEW YORK, May 26—Metropolitan motor truck dealers are beginning to feel acutely the competition of low priced trucks from the former European war areas offered for sale here by representatives of an European corporation which purchased them from foreign governments for export to the United States. The imported trucks, including several American makes and one or two of European manufacture, are being offered at ridiculously low prices as compared with quotations on vehicles manufactured for domestic trade. The imported trucks are also being advertised extensively.

Dealers in some of the higher priced trucks are losing in some cases four or five, and in a few instances more, sales per month.

Representatives of the European corporation which purchased these war trucks from France and some of the other governments which participated in the recent war bought the vehicles, which are new, and in most cases in good condition except for the electrical equipment, at very low prices. Under the present law they are able to ship them into this country, providing the trucks are of American make, without duty. Along with the American trucks a few new vehicles of foreign make also are being brought here. These necessarily have to pay duty, but their purchase prices abroad were so low that they can undersell American trucks with similar specifications 30 to 50 per cent.

Buyers Look for Bargains

For a time dealers in New York, as well as in some other cities, did not show much interest in the truck reimportation situation, but now that these trucks are being brought into the market in increased numbers and their sales are being supported by vigorous advertising, dealers are realizing that there has been raised up a very serious item of sales resistance. The fact that the present period is one in which a great many buyers are looking for bargains, naturally helps the agents.

Dealers here are looking to the National Automobile Chamber of Commerce and the National Automobile Dealers Association to exert the utmost pressure upon Congress and officials of the Administration to place a duty on these reimported trucks which will force their prices up to the domestic level.

Overland Cuts Down Current Liabilities

Annual Report Shows Reduction of $14,000,000 in Year—Inventory Drops

NEW YORK, May 27—The facts that made it necessary for the Willys-Overland Co. to ask for extension of its bank loans in 1920 were revealed in the annual report issued yesterday. This showed, however, that important progress had been made in marking down current liabilities, as that item at the close of last year stood at $28,868,386, compared wih $42,519,660 at the end of 1919.

Notes payable, including bank loans of $20,985,000, totaled $24,288,653 on Dec. 31 last, contrasted with $30,360,000 the corresponding date of the previous year. Inventories were reduced in the two-year period from $38,716,624 to $35,309,825. As regards the company's bank loans, bankers state that since the first of the year a further reduction has been accomplished.

Net earnings of the company for 1920, after deducting repairs and maintenance of the properties and bad and doubtful accounts, but before deducting adjustment of inventories to market value and losses on investments in affiliated companies were $8,822,152. From this was deducted $2,114,243 for interest, $3,768,264 as reserve for accruing renewals, depreciation and provision for tool replacements, leaving a balance of $2,939,644.

After allowing for preferred dividend requirements there remained a surplus for the $56,146,675 common stock, $25 par value, of $1,750,934, equal to 77 cents a share. This compared with $2.26 a share earned in 1919. After payment of the dividends on both classes of stock there was an actual deficit of $173,166.

In a letter to stockholders accompanying the report, John N. Willys, president, explained that the company's surplus account had been adjusted through the application of extensive depreciation and reserve items on inventory and material accounts.

Operating Condition Good

"It is believed," Willys stated, "that the reserves and depreciation thus taken are sufficient to place the company in a satisfactory operating condition. The effect of the application of reserves and depreciation provided against inventories and materials is to place the company's whole inventory and forward commitments upon the basis of low current market replacement values. In addition to the reserves and depreciation thus taken, a depreciation of $6,931,693 has been taken on investments in affiliated companies, the total of all depreciation and reserves being $26,101,711.

"Readjustment of the company's plant account has been made on the basis of 20 per cent less than the actual sound value determined by the American Appraisal Co. Branch house properties are carried at their book value, $5,961,811, whereas a recent valuation gives these properties a sound value of approximately $10,000,000."

Mr. Willys said the business of the company had increased steadily since the first of the year, resulting in a substantial liquidation and a betterment of cash position. The company's total indebtedness on May 1, he said, was approximately $20,000,000 less than on the corresponding date a year ago.

Exports of Automobiles, Airplanes, Trucks, Farm Tractors, Motorcycles and Parts for April and Nine Previous Months

	Month of April				Ten Months Ending April			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Airplanes	3	$10,214	2	$15,000	42	$216,694	56	$416,955
Airplane parts	..	53,651	..	5,486	..	435,194	..	148,930
Commercial cars	2,659	4,169,743	609	811,841	18,465	32,503,156	16,714	28,176,471
Motorcycles	4,061	1,118,227	864	299,172	28,160	7,716,070	23,593	7,453,259
Passenger cars	14,367	15,067,211	2,469	2,931,233	87,796	94,463,419	79,987	98,756,146
Parts, not including engines and tires	..	6,791,967	..	3,195,734	..	50,480,715	..	61,992,710

Engines

	Month of April				Ten Months Ending April			
	1920		1921		1920		1921	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobile, gas	2,735	$464,250	1,108	$223,311	31,340	$4,773,511	12,429	$2,288,174
Marine, gas	814	281,255	498	146,156	7,779	2,763,186	6,231	2,357,265
Stationary, gas	2,509	435,143	804	138,415	22,492	3,370,152	21,888	4,227,058
Tractor, gas	2,488	2,762,687	50	62,289	16,236	15,256,309	13,389	13,446,086
Total	8,546	$3,943,335	2,460	$570,171	77,847	$26,163,158	53,937	$22,318,583

MITCHELL REDUCES PRICES

RACINE, WIS., May 26—Mitchell Motors Co., Inc., announces reductions ranging from $210 to $260 in the price of its cars. The factory price of the touring model has been cut from $1750 to $1490 and the sedan from $2900 to $2690.

DE PALMA SETS TRACK MARK

INDIANAPOLIS, May 26—Ralph DePalma, driving the Ballot special in which he will compete in the 500 mile race Monday, broke the track record for 183 cu. in. piston displacement cars on the Speedway yesterday in qualifying for the contest. His average speed for 10 miles was 101.1 miles an hour.

DODGE DOWN FOR HOLIDAY

DETROIT, May 26—Employees of the Dodge Brothers Motor Car Co. were informed when they quit work last night that they need not report again until next Tuesday. The plant will operate two or three days next week.

CORRECTION

Prices on the Matthews light and power plants have been reduced $50 on the 300-watt and 6 kw. plants, and from $3,600 to $2,975 on the 6 kw. plant. It was erroneously stated in the May 19 issue that prices had been reduced $150. The plants are made by the Matthews Engineering Co., Sandusky, Ohio.

Parts Orders Drop in Last of Month

(*Continued from page* 1126)

facturers regarding what course they are going to pursue on the question of prices. Definite and positive announcements in this respect are needed, parts makers and dealers believe.

Even those watching the situation most closely are uncertain about what the next few weeks will bring in the way of business. Conditions are so topsy-turvy there seem to be no precedents to be followed in making preparations. As a consequence, caution is being exercised all along the line in the manufacturing end of the industry. There is no pessimism, however, and the general feeling is that the present decline in business is partly seasonal and partly due to uncertainty about prices.

Goodyear Sees Falling Off

AKRON, May 24—An official statement issued to-day by the Goodyear Tire & Rubber Co. now in control of the banking syndicate which refinanced it says:

"The seasonal spring spurt of the automobile industry has settled back to a less active situation and curtailment of production of automobiles and parts, including tires, seems likely at once."

No definite information has been given out concerning the Goodyear production plans but there probably will be a reduction in the number of employees.

"We are sending out inquiries as to where men are wanted and efforts will be made to steer the men now laid off to these jobs," said the statement.

Goodyear had reached a production of 19,000 tires a day and reemployed nearly 4000 men since March. Other rubber companies in Akron which also had increased production have begun to reduce their forces.

INDUSTRIAL NOTES

Standard Crucible Steel Casting Co., Milwaukee, is planning important improvements and enlargements to its plant, which is widely known in the automotive industries. Plans are under consideration for a new pattern storage and office building, 3 stories, 35 x 120 ft., and the present foundry and core-room will be enlarged and modernized throughout. George F. Birkel is secretary-treasurer and general manager.

Luthy Co., Inc., has acquired the plant formerly owned by Berger & Carter, manufacturers of cannery machinery, Hayward, Cal. The output of the plant is to be 400 batteries a day. Executive offices are in San Francisco.

Rome Wire Co. has opened district sales offices at 50 Church Street, New York, which will be in charge of H. S. Hammond. Manufacturing facilities have been extended at the plants in Rome and Buffalo.

Robinson Carburetor Co., Birmingham, Ala., has been granted a permit to erect a plant for the manufacture of the Robinson carburetor. The company has been operating on a small scale.

H. H. Franklin Mfg. Co., Syracuse, N. Y., is pushing construction on its new manufacturing building and power plant. Both buildings will be completed by Sept. 1.

Motch & Merryweather Machinery Co., Cleveland, has taken over the sale of the Gordon Cam Turning Lathe in Cleveland, Cincinnati, Detroit and Pittsburgh.

Clark-Turner Piston Co., Los Angeles, has appointed Harkness-Hillier, Ltd., Sydney, Australia, as distributor in Australia of its pistons.

Rice-Fern Hub. Co. will move its plant from Marengo, Ind., to English, Ind., where it has two sites under consideration.

Hirsig Sales Co., Nashville, has been appointed southern representative for Multibestos brake lining.

Dyneto Creditors Seek Plan for Refinancing

SYRACUSE, N. Y., May 23—C. Hamilton Sanford, chairman of the creditors' committee of the Dyneto Electric Corp., has sent to creditors a statement of the assets and liabilities of the company as compiled by certified accountants. With the statement is a letter from Sanford discussing a new financing scheme. The letter in part says:

"Shipments have been running at a rate of about $50,000 per month and will continue until July 1. After that date orders are booked that will amount to about $15,000 or $20,000 per month.

"Your committee has asked interests representing a large amount of capital stock to submit to them plans for the refinancing of the company not later than June 1 and upon receipt of any such plans a meeting of the creditors will immediately be advised, providing such plans are worthy of consideration."

The statement of the company as of Dec. 31, 1920, shows current assets of $56,453, compared with current liabilities of $674,782. Included in the company's assets are the inventory figures, $436,515. According to the accountant's calculations the amount should be approximately $43,000 less. Account receivable from R. M. Owen & Co., and investment in Owen unit tools, machinery and development, totaling $458,177, are excluded from current assets.

The company experienced a net loss of $95,977 for the year ended Dec. 31, last, having the balance in its surplus account reduced to $75,617, the statement shows.

Skelton Motors Held by Estate of Founder

ST. LOUIS, May 23—The formal announcement made here early in March that the assets of the Skelton Motors Corp. of this city had been purchased from the late Dr. L. S. Skelton by W. F. Traves of Kansas City, was premature. No change in the ownership of the Skelton Motors Corp. has taken place and no successor to Dr. Skelton has been appointed. The administrators of his estate are looking after his interests in the company.

Traves is in no way connected with Skelton Motors and John A. Schroeder, chief engineer, severed his connection with the corporation a month ago. The only acting officers at this time are W. A. Chapman, vice president and general manager, and Sidney Penniman, secretary and treasurer.

Since the death of Dr. Skelton last January, Skelton Motors has been in process of reorganization. Plans are now being formulated for the furtherance of the business and an announcement regarding them is expected soon.

Havana Show Closes After Successful Run

NEW YORK, May 23—Information just received by El Automovil Americano, the Spanish automotive business magazine of the Class Journal Co., is to the effect that the automobile show at Havana, Cuba, closed after an eminently successful four days. Known as the Feria de Sevilla, the exposition was quietly arranged by Havana dealers with little help from American manufacturers. Thirteen makes of passenger cars, twelve makes of trucks and two tractors were shown in a large tent in the Almendares athletic field and so satisfactory was it that the Havana Asociacion de Comerciantes y Industriales are contemplating the holding of a larger and more complete show.

The car exhibits were Stutz, Studebaker, Singer, Cunningham, Oldsmobile, Minerva, Benz, Paige, Hudson, Westcott, Packard, Chandler and Cleveland. The trucks were Maxwell, Packard, Garford, Benz, Panhard-Levassor, Republic, Ford, Armleder, Delahaye, Latil, Maccar and Mack. The tractors shown were Case and Fordson.

F. WILLIAM GARTMAN DIES

YORK, PA., May 21—The death is announced of F. William Gartman, vice-president of the York Electric & Machine Co.

METAL MARKETS

WITH the state of morbid drowsiness that has come over the steel market becoming more and more pronounced from day to day, the rest cure, which is being prescribed in some quarters as the most sensible treatment, calls for very little restraint on the part of the patient. Up to now automotive demand furnished a fairly sustaining diet, which was all the more beneficial as it was thought that meanwhile other classes of consumers would set their house in order and re-enter the market as buyers. This expectation has proved false, and what automotive demand is now in the market is of so pronounced a hand-to-mouth character as to furnish to producers little of a dependable basis on which to frame operating programs. Here and there one hears advocated as the most efficient cure a major operation to remove with one incisive cut of the knife most of the adipose fat that has clung to steel prices ever since the war. For the time being, however, quotations will in all probability be permitted to stand, which portends one or two conditions. Either the limited demand will be sufficient to allow of the maintenance of a modicum of operations, and, in that event, intensive competition, accompanied by much price cutting, may be anticipated. The other alternative is that demand will drop to so low levels as to make it less costly for producers to shut down than to continue operations. Should there be many such shut-downs, buyers would be confronted with hardships even greater than those encountered in a market in which demand exceeds capacity production. It is, therefore, decidedly to the buyer's interest not to permit his sources of supply to dry up, if he can at all prevent it. The immediate outlook is for drifting prices, cuts under published quotations expressing the individual eagerness of mills to avoid shutting down to maintain operations on a self-sustaining basis. In the pig iron market a much better tone is in evidence. The same is true of those non-ferrous metal markets in which liquidation has been thorough. That further downward revision of steel prices is a prerequisite to its recovery is generally admitted by producers. Wherein they differ is as to the proper time for proclaiming this lower scale of prices. Possibly the course toward which the present drifting market is heading may force the hands of those who hold that price revision should be postponed.

Pig Iron.—While large transactions are lacking, the market, as a whole, is in much better spirits. Automotive foundries are buying in a retail way, but consumers show much more confidence and seemingly would buy much more liberally if conditions in their own trades warranted.

Aluminum.—From what can be learned regarding the probable recommendations of the Committee on Ways and Means with reference to the rates of duty on aluminum under the new tariff law, it is certain that the duty that will be enacted into law will be far below that provided in the Payne-Aldrich law, i.e., 7c. per lb. on aluminum in ingots, scrap and alloys and 11c. per lb. on aluminum plates, sheets, bars and rods. The American producer has been advocating re-adoption of this scale of duties. Consumers have been driving home to the legislators the argument that, if such increased duties protected the American aluminum industry from foreign competition, they would so curtail American consumption that in the end the American producer would be little the gainer by them. Activity in the aluminum market is absolutely confined to last year's contracts.

FINANCIAL NOTES

Westinghouse Electric & Mfg. Co. reports gross earnings from sales for the year ended March 31, 1921, as $150,980,000, an increase of $15,000,000 over gross earnings for the previous year. Manufacturing and selling cost was $138,774,000, leaving $12,618,000 as the net income available for dividends, or 16.8 per cent on the company's capital stock. Included in the cost is $5,315,000 for depreciation and adjustment of inventories.

Stromberg Carburetor Co. of America, in a comparative balance sheet as of Dec. 31, shows total assets of $3,390,301, included in which are current assets of $841,702 for inventory and $109,322 cash and demand loans. Accounts receivable total $242,274. Current liabilities include accounts payable $102,934 and notes payable $150,000. Profit and loss surplus is $2,344,943, and there is $311,954 reserve for depreciation.

Hood Rubber Co. is contemplating the issuance of $3,000,000 to $5,000,000 in notes for the purpose of paying off bank loans and for working capital. As of Dec. 31 the company had notes payable of $3,610,000 as against $4,860,000 at the close of 1919. Current assets at the first of the year were $17,829,206, against which were current liabilities of $10,051,222, leaving net current of $7,777,894.

United States Rubber Co. directors are aiming to reduce bank loans aggregating $50,000,000 on Dec. 31, 1920, by one-half during the current year. The company is not considering any new financing and does not expect to find this necessary. The company has used up practically all of its high-priced rubber and is taking advantage of current low prices to pick up a reserve.

Rolls-Royce of America, Inc., in a comparative balance sheet as of Dec. 31, shows assets of $7,952,502, which includes an inventory of $1,003,699; cash and accounts receivable, $272,026; deferred charges, $385,225; patent rights, trademarks, goodwill, $3,600,000, and interest during construction, etc., $788,750. The company's surplus is $4,849.

Maxwell-Chalmers Co. stockholders of Class A and Class B stock have been notified by the reorganization committee, which is headed by Walter P. Chrysler, to pay the balances on this stock by June 1 to the Central Union Trust Co. Failure to make the payments will forfeit all rights of purchase under the subscription warrants.

Stevens-Duryea, Inc., in a comparative balance sheet as of Dec. 31, shows total assets of $6,075,394, which include $2,438,565 inventory and $264,054 cash and accounts receivable. Liabilities show a surplus of $1,282,137 and a reserve for contingencies of $243,856.

American-Bosch Magneto Corp. has sold through Hornblower and Weeks and Harriman & Co. $2,500,000 in 8 per cent 15-year bonds at 98½ and interest, the proceeds of which will be used to pay off floating debt and provide additional working capital.

Mason Tire & Rubber Co. has made financial arrangements for building the Western Reserve Cotton Mills Co. for the manufacture of tire fabrics. It has issued $4,000,000 8 per cent cumulative preferred stock and $20,000,000 common stock in the new company.

Gruber Tire Co., Monticello, Ohio, will increase its capital stock from $50,000 to $250,000, and will change its name to the Monticello Tire Co. H. O. Altenberg of Davenport will be superintendent.

Goodyear Tire & Rubber Co. has deposited $18,000,000 with the Central Union Trust Co., New York, for payment of a credit of that amount extended by New York bankers. This credit matured May 15.

Fisk Rubber Co. has declared the regular quarterly dividend of 1¾ per cent on the second preferred stock, payable June 15.

G.M.C. Merges Sales of Electric Products

NEW YORK, May 25—Announcement was made to-day by the General Motors Corp. that there is no truth in the report that it proposes to sell the Frigidaire Corp., the Sunnyhome Electric Co. and other units not directly connected with automotive products. On the contrary, the sales of the Frigidaire refrigerator will be extended through the sales organization of the Delco-Light Co. of Dayton. The Sunnyhome company will be consolidated with the Delco company. Both of them manufacture light systems, but there are considerable mechanical differences between them. Sale of the Frigidaire through the Delco organization is considered logical because the refrigerator is electrically operated and is attached to a Delco generator.

It is understood to be the intention of General Motors to continue operation of all three plants for the present at least. Both the Frigidaire and Sunnyhome are located in Detroit.

Townsend Bill Kills Spoils, Says Chapin

WASHINGTON, May 24—Opposition to the Townsend highway bill was indicated by Democratic members of the Senate Post Office and Post Roads Committee to-day in their questioning of Roy D. Chapin, chairman of the higways committee of the National Automobile Chamber of Commerce, who advocated abandoning the present system of Federal aid. Chapin insisted that unconnected stretches of roads were a part of the "spoils" system similar to the erection of large post offices in small towns.

Senator Heflin of Alabama devoted his attention to questioning Chapin concerning the farm-to-market roads. It is this feature of the road situation which inspires opposition from representatives of large farm communities. Chapin pointed out that all progressive states were building such systems connecting with county systems, and thus making a most complete farm-to-market route. He strongly advocated research into highway problems because the industry is only in its infancy. Some of the Senators who questioned Chapin asserted that the automotive industry is the greatest beneficiary from the present Federal aid system.

OBENBERGER PLANT RESUMES

MILWAUKEE, May 23—The plant of the John Obenberger Forge Co. of Milwaukee, a concern which is now passing through the bankruptcy courts, has resumed operations by authority of the referee upon the application of the trustee, J. Frank Gerdis.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

NEW YORK, May 28—The local call money market showed a firmer undertone last week with a comparatively light supply of loanable funds. After renewing at 6½ per cent on the opening day of the week, the rate for call money was advanced on Tuesday to a uniform rate of 7 per cent, at which figure it was quoted for the remainder of the week. The firmer tone was in part a reflection probably of the shifting of funds in connection with the Government operations on May 16 and the payments made on subscriptions to the Great Northern-Northern Pacific joint issue. The time money market was unchanged with little activity and few offerings at rates of 6½ per cent to 6¾ per cent, for 60 to 90 days' and 4 months' paper, and 6 per cent to 6½ per cent for 5 and 6 months' paper.

The Federal Reserve system again made substantial improvement in its reserve position last week. The ratio of total reserves to deposit and Federal Reserve note liabilities combined increased from 55.9 per cent to 56.8 per cent, the highest ratio since the summer of 1918. Federal Reserve notes in circulation at $2,767,415,000 marked a decrease of $37,518,000 for the week and were $637,516,000 below the peak reached on Dec. 23, 1920. Gold reserves increased $15,353,000, while total bills on hand declined $187,774,000. This decrease was largely accounted for by a $142,828,000 decrease in bills discounted and secured by U. S. Government obligations. Deposits declined $16,802,000.

A most significant announcement affecting the railroads and indirectly the general labor situation was that of the Railroad Labor Board in making public its intention of revising the wages of about one million railroad workers to take effect on July 1. The extent of the wage cut to be made has not yet been determined and will be announced on June 1 for all wage disputes submitted to the board prior to April 18. Disputes submitted since that date will be heard on June 6, but will be disposed of with the intention of making the decisions effective on July 1, 1921. This decision concerns, in the main, the unskilled railroad employees, although at least two roads had prior to April 18 asked for wage reductions for all classes of workers.

The stock market was unfavorably affected by announcements of further dividend reductions, etc., in spite of the favorable reception given to the decision of the Railroad Board. The Chesapeake & Ohio and the Hocking Valley railroads deferred action on their dividends and several steel companies passed their dividends. In the bond market there was no marked activity except among the foreign issues, where the smoothing out of the foreign situation and the continued rise in foreign exchanges have been exerting a favorable influence.

MEN OF THE INDUSTRY

Fred H. Williams, for the last seven years an executive in the home office of the White Co. in Cleveland, where he was in charge of the general sales department before being made vice-president of the company, has been appointed, at his own request, general manager of the Philadelphia branch. Operating as a part of this organization are branches in Wilmington and Washington.

Myles Bradley, a former Flint, Mich., newspaper man who directed the affairs of the Durant Corp. while W. C. Durant was at the head of the General Motors Corp., has taken charge of publicity for the new Durant organization. Bradley has had a wide newspaper experience in New York State and Michigan.

John M. Robbins has been placed in charge of the sales department of Huffman Bros. Motor Co., Elkhart, Ind., manufacturers of Huffman trucks. He was formerly with Lozier, Chalmers and Fulton truck, and was also president of the company which formerly bore his name.

Roy E. Breeden has been appointed division sales manager for Service trucks in Michigan and northern Ohio. Walter Dix has been appointed to the Maryland-Virginia district; L. A. Poundstone to the Pennsylvania-New Jersey district, and Fred G. Whipple, the California district.

W. H. Hurley has been appointed general sales manager of the McGraw Tire & Rubber Co., succeeding C. E. Pumphrey, resigned. He has been associated with McGraw for some time in several capacities and before joining the company was connected with Ajax.

J. P. Winterson, a ten-year veteran of the automobile business, has associated with the Stutz Motor Car Co. of America, Inc., as special representative. Winterson has been connected with several of the larger automobile manufacturers, including Lozier and Chalmers.

Glenn A. Toaz has resigned as staff engineer at the Cleveland Automobile Co., Cleveland, to accept appointment as assistant chief engineer of the Butler Mfg. Co., Cleveland, manufacturers of a vacuum street cleaner.

Ivor McCulla has been appointed service manager of the Bijur Motor Appliance Co., Hoboken, N. J. He was formerly with Willys-Overland in a technical service capacity, and before that was with Trego Motors, New Haven, and Packard.

Shirley M. Howe, former general sales manager of the Haynes Automobile Co., has been appointed general sales manager of the passenger car division of the Yellow Taxicab Co., Chicago, manufacturer of the Ambassador.

F. M. Goodman, who has represented the Elgin Motor Car Corp. in the Central States for the past five years, has been appointed district manager of all eastern territory. Goodman's headquarters will be in New York.

Harrie R. Williams, director of sales and advertising for the Milwaukee Auto Engine & Supply Co., manufacturers of timers and bumpers, has resigned. After a rest he will announce his plans for the future.

F. Elbert Glass has been appointed sales manager of the Oakes Co., Indianapolis, manufacturers of accessories. He has been with the company eight years as a sales engineer.

J. T. Lawson has been appointed district supervisor in the Chicago district for Maxwell-Chalmers. He has been connected with the industry for a number of years as field representative, branch manager and dealer.

Judd Colwell, for ten years connected with the Goodyear Tire & Rubber Co. in Chicago, has been made Chicago branch manager of the Miller Rubber Co.

Harry W. Anderson has resigned as sales manager of the Templar Motor Corp., Cleveland. His plans for the future will be announced within a short time.

Andrew Scharff has been appointed northwest district manager for the Multibestos Co., Walpole, Mass. His headquarters will be in Minneapolis.

William Mackone Milner has resigned as advertising manager of the Bergougnan Rubber Corp., Trenton, N. J., and will announce his plans for the future in a short time.

W. K. Swigert has resigned as vice-president and general factory manager of the Oakes Co., Indianapolis. His plans for the future are not announced.

Universal Tool Wins in Reboring Tool Fight

GARWOOD, N. J., May 23—The Universal Tool Co., formerly of Detroit, which now has a factory here, has been granted an injunction by the Federal court, restraining the Flinchbaugh Machine Co., of York, Pa., from further manufacture and distribution of the Universal cylinder reboring tool, invented by R. E. Roseberry. The injunction was granted on the ground that patent rights and trade mark had been infringed.

The Flinchbaugh company has notified jobbers that it has discontinued the sale of these tools and that they now are sold exclusively by the Universal company.

Production of the re-boring tool, embodying new features based on original patents granted Roseberry, was begun here Jan. 1 in the new factory. All tools shipped since April 15 have been of the new design, but no advance in price has been made. Business of the company in April reached normal. February showed an increase of 50 per cent over January and March an increase of 102 per cent over February. The plant now is operating on a 10-hour-a-day basis.

REEVES ANSWERS ATTACK

NEW YORK, May 25—General Manager Alfred Reeves of the National Automobile Chamber of Commerce today began distribution for publication of an answer to statements recently made concerning the automotive industry by F. R. Pleasonton, general manager of the Parish Mfg. Co. Pleasonton's attack, which has been published by several papers, and which has since then been given wide distribution by a large Philadelphia advertising agency, made charges of "dangerous inflation" against the autotive industry, says "distribution has been forced on an unwarranted basis. . . . Millions of cars now in use must be abandoned by their present owners," and claims that no income less than $2,000 should support a car. Reeves points out that many of the statistics in Pleasonton's paper are wrong and that his attack is unsound and unjust. The papers committee of the S. A. E. some time ago refused Pleasonton's document as inaccurate.

Austin to Push Sales of Tractor in Canada

LONDON, May 6 (By Mail)—Austin Motor Co. has a plan arranged to supply Canada with tractors backed by a full service organization including oversight of machines by mechanics from the British works. These men will instruct the agents, their mechanics and the owners how to run and manage this particular tractor.

This development is being awaited with great interest by other British firms, and, if successful, will probably be copied by them, for it was reported at a recent inquiry instituted by the Ministry of Agriculture that British tractor makers will have to look more and more to oversea markets if they are to be able to manufacture in quantities sufficiently large to ensure a selling price on a level with those machines made elsewhere.

This information came through before the announcement of Austin financial trouble; therefore it is possible that the plan may be held up; if not abandoned.

The Ruston-Hornsby Co., which holds the British rights in the Wallis Junior (U. S. A.), also has been named in this connection, but inquiries have failed to prove or disprove the report.

BANTAM DEMAND INCREASES

BANTAM, CONN., May 23—Stockholders of the Bantam Ball Bearing Co. were told at their annual meeting that while orders on the books are not as large as those of previous years, they indicate an increasing demand for the products of the company, and also that an ample organization has been maintained to fill all the orders which come through. Thanks to a conservative policy, the stockholders were told, the company is in an excellent financial condition. The following directors were elected: W. S. Rogers, L. J. Nickerson, H. H. Edwards, N. M. Scott, H. L. Schoonmaker, C. D. Heath and J. L. Buel.

ROLLS SIGNS A. J. ROWLEDGE

LONDON, May 9 (By Mail)—It is announced that Rolls Royce, Ltd., has secured the services of A. J. Rowledge for a long term of years. Rowledge was for many years chief designer with the Wolseley Motor Co., Birmingham, and for the past seven years has been chief designer for the Napier company. With the latter firm he was very largely responsible for the Napier aero engines, as well as for the most recent Napier passenger car chassis.

Calendar

SHOWS

Sept. 28 - Oct. 8 — New York, Electrical Exposition, 71st Regt. Armory, Electric Equipment, Machinery and Vehicles.

Nov. 27-Dec. 3—New York, Automobile Salon, Hotel Commodore.

January — Chicago, Automobile Salon, Hotel Drake.

FOREIGN SHOWS

June, 1921—Reykjavik, Iceland, Agricultural Exhibition—Agricultural Machinery—Icelander Agricultural Society, Reykjavik, Iceland.

September—Buenos Aires, Argentina, Passenger Cars and Equipment. La Pabellon de las Rosas. Automovil Club Argentino.

September—Buenos Aires, Argentina, Cars, Trucks, Tractors, Farm Lighting Plants and Power Farming Machinery. Palermo Park; Sociedad Rural Argentina.

September—Luxemburg, Luxemburg, Agricultural Sample Exhibition.

Oct. 5-16—Paris, France, Paris Motor Show, Grand Palais, Administration de l'Exposition Internationale de l'Automobile, 51, Rue Pergolèse, Paris.

Nov. 4-12 — London, British Motor Show, Society Motor Mfrs. and Traders.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

CONVENTIONS

July 4-9 — Mackinac Island, Mich., Summer Meeting Automotive Equipment Association.

Oct. 12-14, 1921 — Chicago, Twenty-eighth Annual Convention National Implement & Vehicle A'ssn.

Nov. 22—New York, Convention of Factory Service Managers, National Automobile Chamber of Commerce.

RACES

May 30 — Indianapolis, International Sweepstakes.

June 3-5 — Reno, Nev., First Annual Nevada Highway Road Race.

June 18—Uniontown, Pa., Speedway Events.

July 25—Grand Prix, Le Mans.

Labor Day—Uniontown, Pa., Autumn Classic.

Twenty-five Entries for Indianapolis Race

INDIANAPOLIS, May 26—Following are the entries and drivers in the 500-mile sweepstakes to be run Decoration Day:

CAR.	DRIVER.
ReVere Special	Eddie Hearne
Ballot Special	Ralph DePalma
Leach Special	Ira Vail
Durant Special	Tommy Milton
Duesenberg Special	James Murphy
Duesenberg Special	Roscoe Sarles
Duesenberg Special	Edw. Miller
Duesenberg Special	Eddie Pullen
Frontenac Special	Ralph Mulford
Frontenac Special	
Peugeot Special	Howard Wilcox
Talbot-Darracq Special	Andre Boillot
Sunbeam Special	Rene Thomas
Sunbeam Special	Dario Resta
Junior Special	R. J. Brett
Junior Special	
Peugeot Special	Jean Chassagne
Duesenberg Special	John A. Thiele
Frontenac	Jules Ellingboe
Chicago-Frontenac Special	Percy Ford
Duesenberg Special	Joe Boyer
Duesenberg Special	Albert Guyot
Frontenac Special	C. W. Van Ranst
Frontenac Special	M. E. Headley
Frontenac Special	L. L. Corum

India Presents Field for Rebuilt Engines

WASHINGTON, May 24—A specific need for light internal combustion engines in India for direct coupling to centrifugal pumps, used to carry water from wells, has come to the attention of Trade Commissioner Batchelder. A light engine is desired, similar to the motor car engine, which can be directly coupled with suitable centrifugal pumps and thus save the extra cost of belting, the friction and slip losses. In connection with coupling the pump with the engine an arrangement will be necessary to start the engine light, preventing the water from pumping and thus loading the engine, until sufficient speed has been gained. The average depth of the wells may be assumed as 150 ft. and the average discharge 160 gal. of water a minute. As the water will be used for irrigation the exhaust fumes of the engine will not affect its use for that purpose. Batchelder, who has been advised that this is one of the best fields for American machinery in India, thinks that rebuilt automobile engines might be fitted for such purposes, or that manufacturers might design the exact type of engine that is needed.

Mulford in Paige Makes Chassis Marks

UNIONTOWN, PA., May 20—Ralph Mulford, driving a Paige, broke all records for stripped stock car chassis in a spectacular performance at the Uniontown Speedway to-day. He established new world's records for five miles, 10 miles, 15 miles, 20 miles, 25 miles, 50 miles, 75 miles, one hour and 100 miles. In the run is a new record for one mile on such a course, although the mile and time remain to be chosen, approved and announced officially by the American Automobile Association contest board.

Mulford's record, unofficially, was 89.6 miles per hour average for the 100 miles. He actually made 89.9 in the hour but it is understood that under rulings of the Three A regarding completion of the mile, he can be credited with only 89 miles, flat, for the hour.

The event was under official sanction of the Three A with G. E. Edwards, chairman of the technical committee, and A. H. Means, secretary of the contest board, in direct charge, assisted by Frank H. Rosboro, local representative of the Three A.

Trucks in Philippines Cut Railroad Earnings

SEATTLE, May 23—So intensive has been the development of motor truck transportation in the Philippine Islands during the last year that the Manila Railroad Co. has appealed to the Government for relief, claiming that the automotive carriers are cutting heavily into the profits of the company.

In the annual report of the general manager of the company it is stated that if the truck, operating as a common carrier, is taxed with a view to reimbursing the Government for the wear and tear it occasions to the road surface, plus its proportionate share of the interest on investment in the highway, then the problem is automatically solved.

Service Lack Ties Up Car Usage in Peru

LIMA, PERU, May 2 (By Mail)—Automotive dealers of Lima and other cities of Peru consider that the present is a big opportunity here now for the sale of spare and repair parts and repair materials. Many cars and trucks, not only in Lima, but also throughout Peru, are laid up because of a lack of service facilities. Firms manufacturing standardized parts should endeavor to reach this market in order that these vehicles may be put back on the roads at once.

Efforts are being made to have the road between Lima and Callao repaired so that truck traffic over it may not be delayed. Callao is the port of entrance for imports to Lima and many of the shipments are transported from there by truck. About twenty of the firms most interested in the handling of such shipments have combined in an effort to obtain betterment of the present conditions. Otherwise they are threatened with a cessation of transport.

Preparations are continuing apace for the opening on July 15 of the industrial exposition to be held in connection with the centenary celebration of Peruvian independence. Although there is a market stagnation, several automotive companies, it is understood, will have exhibits. It is suggested that manufacturers of repair and service parts would undoubtedly find this to be a profitable exhibition.

FORT WAYNE PLANTS BUSY

FORT WAYNE, IND., May 21—The increase in business at the plants of a number of local companies indicates that the worst of the depression which has been affecting local companies for some months is past.

The Dudlo Mfg. Co., makers of magnet wire, which started to show increased signs of life several weeks ago, is continuing to add to its forces by recalling former employees. The plant is now operating on a basis of 75 per cent normal. For the first time since the depression started, some of the departments have been operating overtime. This is particularly true of the department making wire for Ford.